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UNITED STATES DEPENDENCE ON IMPORTS OF FOUR STRATEGIC AND CRITICAL MINERALS: IMPLICATIONS AND POLICY ALTERNATIVES

G. Kevin Jones*

I. INTRODUCTION

[O]ur survival as a leading nation depends on our mineral supplies. The close relation between minerals and our national security is too apparent to require detailed explanation.

Public Land Law Review Commission, *One Third of the Nation's Land, A Report to the President and to the Congress* 121 (1970).

The United States is dependent upon the import of many nonfuel minerals¹ that are essential to its national security and economy.²

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This Article expresses the author's personal opinions and does not necessarily reflect the opinions, policies, or positions of the Department of the Interior or its offices. The Editorial Board of the *Environmental Affairs Law Review* would be pleased to receive a response to this Article.

¹ The term nonfuel minerals means all raw materials of mineral origin with the exclusion of food and of energy fuels such as petroleum, gas, and solid fuels. 30 U.S.C. § 1601(b)(1982); Exec. Order No. 10,529, 19 Fed. Reg. 2397 (1954); Exec. Order No. 11,490, 34 Fed. Reg. 17,567 (1969).

² S. REP. NO. 897, 96th Cong., 1st Sess. 2 (1980), reprinted at 1980 U.S. CODE CONG. & ADMIN. NEWS 4871, 4872 [hereinafter S. REP. NO. 897].

Minerals are so fundamental to a civilization that mankind's technological progress is categorized according to man's developing ability to use minerals effectively. Mankind has advanced from the Stone Age, through the Bronze Age, Iron Age, Coal Age and the Petroleum Era. The Bronze Age began when man "mastered certain elementary metallurgical techniques. The [economic] revolution that accompanied this event signified more inventions and discoveries than in any period of human history until the sixteenth century." Viljoen, *Minerals From the Dawn of Mankind to the Twenty-First Century*, 79 J.S. AFRICAN INST. MINING & METALLURGY 410, 410 (1979).

The United States is dependent upon foreign sources of supply for more than fifty percent of twenty-four out of thirty-two strategic minerals.³ Furthermore, United States dependence upon foreign sources of supply will increase as strategic minerals become increasingly important in meeting the demands of new technology in the energy industry,⁴ in making the nation's steel industries competitive internationally,⁵ and in research programs for the Strategic Defense Initiative (Star Wars).⁶

Of the minerals upon which the United States is dependent for foreign sources of supply, chromium, cobalt, manganese, and platinum group metals are the most critical.⁷ These metals are the "metallurgical Achilles' heel"⁸ of United States strategic mineral supply because their role in the economy is pervasive and because they are

For discussions on nonfuel minerals and the United States, see generally THE MINERAL POSITION OF THE UNITED STATES, 1975-2000 (E. Cameron ed. 1973); J. TILTON, THE FUTURE OF NONFUEL MINERALS (1977); A *Symposium on Primary Resource Scarcity Effects on Trade and Investment*, 24 AM. U.L. REV. 1087 (1975); *Symposium, World Mineral Resources: Development, Trade, Outlook*, 12 J. INT'L L. & ECON. 157 (1978).

³ *The U.S. Stake in the Global Economy: Hearings on the Implications for the United States of the Accumulation of External Debt by Developing Countries Before the Subcomm. on International Economic Policy of the Senate Foreign Relations Comm.*, 97th Cong., 1st Sess. 3 (1981) [hereinafter *Hearings on U.S. Stake in Global Econ.*] (statement of Rep. James D. Santini, Nev.). See also Sheets, *America's Gap in Strategic Minerals*, U.S. NEWS & WORLD REP., Feb. 8, 1982, at 59.

The United States imports more than 40% of its supply for 34 of the 90 known mineral materials and is more than 90% dependent upon foreign sources for 16 mineral commodities. *The National Critical Materials Act of 1984: Hearings Before the Subcomm. on Transportation, Aviation and Materials of the House Comm. on Science and Technology*, 99th Cong., 1st Sess. 170 (1985) [hereinafter *Hearings on Nat'l Critical Materials Act*] (statement of Robert Dale Wilson, Director, Office of Strategic Resources, United States Department of Commerce).

⁴ See OFFICE OF TECHNOLOGY ASSESSMENT, STRATEGIC MATERIALS: TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY 77-78 (May 1985) [hereinafter TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY]; GENERAL ACCOUNTING OFFICE, REPORT TO THE CONGRESS, MINERALS CRITICAL TO DEVELOPING FUTURE ENERGY TECHNOLOGIES, THEIR AVAILABILITY, AND PROJECTED DEMAND (June 25, 1984); GENERAL ACCOUNTING OFFICE, REPORT TO THE CONGRESS, LEARNING TO LOOK AHEAD: THE NEED FOR A NATIONAL MATERIALS POLICY AND PLANNING PROCESS 36-37 [hereinafter LEARNING TO LOOK AHEAD] (Apr. 19, 1979) [hereinafter NEED FOR NATIONAL MATERIALS POLICY & PLANNING].

⁵ *Hearings on Nat'l Critical Materials Act*, *supra* note 3, at 1 (statement of Rep. George E. Brown, Jr., Cal.). The development of new technologies to revitalize the Nation's depressed steel industries would cost approximately \$1 billion. *Id.*

⁶ *Id.* at 2.

⁷ Holden, *Getting Serious About Strategic Minerals*, SCIENCE, Apr. 17, 1981, at 305.

⁸ Meyer, *How We're Fixed for Strategic Minerals*, FORTUNE, Feb. 9, 1981, at 68. See also *Foreign Metals—An Achilles' Heel for U.S.*, U.S. NEWS & WORLD REP., Mar. 19, 1985, at 74 [hereinafter *Foreign Metals*].

vulnerable to supply interruption.⁹ Three nations, South Africa, Zaire, and the Soviet Union, produce over half of the world's chromium, cobalt, manganese, and platinum group metals.¹⁰ These metals are essential to the industrial production of the United States.¹¹ They are used in manufacturing high-temperature alloys, steel, automotive catalysts, electronics, aircraft engines, modern weapons, telecommunications, as well as oil refining and chemical processing.¹²

With limited exceptions, the United States has no domestic commercial production of chromium, cobalt, manganese, or platinum group metals and thus an alternate supply of the four metals is not readily available.¹³ The federal government maintains a national defense stockpile, but the stockpile materials are available for national security purposes only.¹⁴ Furthermore, the stockpile contains reserves "far below what they should be today and far below what our national policy originally conceived as necessary."¹⁵ As a result, the United States is increasingly dependent on foreign sources of strategic materials and is vulnerable to a variety of supply interruptions.¹⁶ Former Congressman James Santini has warned about the potentially dangerous effects to the United States economy and national security resulting from a minerals supply interruption.¹⁷

This Article examines the importance of nonfuel minerals to the United States and its increasing dependence on foreign sources of mineral supplies. Chromium, cobalt, manganese, and platinum group metals are the primary minerals discussed. The Article also identifies governmental actions that have impeded the onshore mining industry and considers past minerals policy. Other issues that this Article

⁹ TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 11.

¹⁰ *Id.* at 3.

¹¹ *Id.* See also 30 U.S.C. § 1801(a)(1) (Supp. III 1985).

¹² TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 3; *Foreign Metals*, *supra* note 8, at 74; *America's Gap in Strategic Minerals*, *supra* note 3, at 59.

¹³ TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 3.

¹⁴ *Id.*

¹⁵ *Nonfuel Minerals Policy Review: Oversight Hearing Before the Subcomm. on Mines and Mining of the House Comm. on Interior and Insular Affairs, Part III*, 96th Cong., 2d Sess. 9 (1980) [hereinafter *Nonfuel Minerals Policy Review, Part III*] (statement of General Alexander M. Haig, Jr., President and Chief Operating Officer, United Technologies Corp.).

¹⁶ TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 3; 30 U.S.C. § 1801(a)(2) (Supp. III 1985).

¹⁷ According to Mr. Santini, "[w]ithout a continued supply of mineral imports, our entire industrial base would be shattered and our defense capability would be crippled." *Hearings on U.S. Stake in Global Economy*, *supra* note 3, at 3 (statement of Rep. James D. Santini, Nev.).

examines include factors that affect United States security of mineral supply and recommended approaches to reduce United States import dependency upon foreign mineral supply sources.

II. THE ROLE OF NONFUEL MINERALS IN THE UNITED STATES ECONOMY

A. *The Current United States Posture on Nonfuel Minerals*

An adequate nonfuel minerals supply is essential to the economies of the United States and other industrialized nations.¹⁸ The American standard of living is dependent upon nonfuel minerals.¹⁹ Currently, the United States economy requires four billion tons of new mineral supplies annually, or about 41,000 pounds per person.²⁰ With six percent of the world's population, the United States consumes about thirty percent of the world's mineral production.²¹ Indeed, the United States has consumed more minerals during the past thirty years than in the total history of man to date.²²

¹⁸ HOUSE COMM. ON BANKING, FINANCE AND URBAN AFFAIRS, REPORT TO THE SUBCOMM. ON ECON. STABILIZATION, 97TH CONG., 1ST SESS., A CONGRESSIONAL HANDBOOK ON U.S. MATERIALS IMPORT DEPENDENCY/VULNERABILITY 2 (Comm. Print 1981) [hereinafter CONGRESSIONAL HANDBOOK]. See also 30 U.S.C. § 1601(a)(1) (1982); 30 U.S.C. § 1801(a)(1) (Supp. III 1985).

The economies of all developed countries are heavily dependent upon nonfuel minerals. Every \$10 million worth of nonfuel minerals injected into an economy generates about \$250 million worth of total economic activity. For certain industries the multiplier effect is even greater. For illustration, \$4 billion worth of petrochemicals contributes to approximately \$430 billion worth of industrial products. CONGRESSIONAL HANDBOOK, *supra* 18, at 2. The value of materials produced annually in the United States from nonfuel minerals is approximately \$200 billion. *Nonfuel Minerals Policy Review: Oversight Hearings Before the Subcomm. on Mines and Mining of the House Comm. on Interior and Insular Affairs, Part I*, 96th Cong., 1st Sess. 29 (1979) [hereinafter *Nonfuel Minerals Policy Review, Part I*].

¹⁹ STAFF OF HOUSE SUBCOMM. ON MINES AND MINING OF THE COMM. ON INTERIOR AND INSULAR AFFAIRS, 96TH CONG., 2D SESS., REPORT ON U.S. MINERALS VULNERABILITY: NATIONAL POLICY IMPLICATIONS 1 (Comm. Print 1980) [hereinafter U.S. MINERALS VULNERABILITY REPORT]. The dependency of America's industrial society is illustrated by the fact that a color television set contains about 35 different mineral commodities, and that a telephone contains about 40. *Id.* at 5.

²⁰ CONGRESSIONAL HANDBOOK, *supra* note 18, at 3, 76. This annual requirement of raw materials reflects the industrialization of the United States economy.

At the time of the Revolutionary War the annual per capita consumption of minerals in the colonies is estimated to have been around 1,200 pounds, of which 1,000 pounds were sand and gravel; 112 pounds brick and lime; 40 pounds coal; 20 pounds iron; and the balance copper, glass, lead, potash, salt, nitrates, sulfur, and zinc.

Id. at 76.

²¹ *Id.* at 3.

²² GENERAL ACCOUNTING OFFICE, REPORT TO THE CONGRESS, IMPLEMENTATION OF THE NATIONAL MINERALS AND MATERIALS POLICY NEEDS BETTER COORDINATION AND FOCUS 2

The high consumption of the world's raw materials, particularly by the United States, Europe, and Japan,²³ has led to concern about possible exhaustion of the world's mineral reserves.²⁴ Commentators have predicted an end to the affluence²⁵ and growth patterns²⁶ that characterize our modern society. These studies forecast the imminent depletion of the world's raw materials,²⁷ suggesting that the

(1984) [hereinafter IMPLEMENTATION OF THE NATIONAL MINERALS AND MATERIALS POLICY]. See also MacGregor, *International Mineral Development*, 17 ROCKY MTN. MIN. L. INST. 205 (1972); CONGRESSIONAL HANDBOOK, *supra* note 18, at 3.

The high United States consumption of the world's raw materials, disproportionate to its population, has been criticized by developing states of the Third World as inequitable and has been questioned by commentators at home as unfair to future generations. For discussions on the ethical concerns and justifications of the high consumption rates of nonfuel minerals in industrialized countries, see Williams, *Running Out: The Problem of Exhaustible Resources*, 7 J. LEGAL STUD. 165, 181-85 (1978); Note, *Nonfuel Mineral Cartels—United States Economic Policy and Changing World Resource Patterns*, 7 L. & POL'Y INT'L BUS. 863, 874-83 (1975).

²³ CONGRESSIONAL HANDBOOK, *supra* note 18, at 3.

²⁴ See, e.g., 50 U.S.C. app. § 2169(b)(3) (1982); H. BARNETT & C. MORSE, SCARCITY AND GROWTH: THE ECONOMICS OF NATURAL RESOURCE AVAILABILITY (1963); P. CONNELLY & R. PERLMAN, THE POLITICS OF SCARCITY: RESOURCE CONFLICTS IN INTERNATIONAL RELATIONS (1975); THE ECONOMICS OF NATURAL RESOURCE DEPLETION (D. Pearce ed. 1975); D. NOVICK, A WORLD OF SCARCITIES (1976); Ragsdale, *Ecology, Growth and Law*, 16 CAL. W.L. REV. 214, 240-50 (1980).

²⁵ See, e.g., P. EHRLICH & A. EHRLICH, THE END OF AFFLUENCE (1974). One commentator has written that the United States has entered an era of diminishing expectations, and this has produced a profound effect on the national psyche.

We are launched on the early stages of the process of diminishing expectations. It is a painful process, a response to deep loss, a feeling akin to a form of grief. . . .

Our expectations of "more" have been ravaged. We are just beginning to face the prospect of "less." We don't know what it means. We don't know how bad it is going to be. And deep down in our hearts, we don't believe it. Or perhaps it would be more accurate to say that we don't know quite what to believe.

Yankelovich, *Reagan and National Psyche*, PSYCHOLOGY TODAY, Jan. 1982, at 5, 6.

²⁶ See, e.g., D. MEADOWS, D. MEADOWS, J. RANDERS & W. BEHRENS, THE LIMITS TO GROWTH: A REPORT FOR THE CLUB OF ROME'S PROJECT ON THE PREDICAMENT OF MANKIND (1972).

²⁷ Table 1, on which the preservationist school bases its argument, suggests that the depletion of the world's raw material resources is imminent. See also Heilbroner, *Growth and Survival*, 51 FOREIGN AFF. 139, 141 (1972).

However, some prominent scholars differ with the "limits to growth" advocates and maintain that the world is not running out of raw materials. The technological inventory of the earth's resources is incomplete, and, therefore, we do not know the extent of resources that can ultimately be recovered from the earth. In addition, as illustrated in Table 2, world resources have increased over the 20 year period from 1950 to 1970 as demand has increased. Simon, *The Scarcity of Raw Materials: A Challenge to the Conventional Wisdom*, ATLANTIC, June 1981, at 33. For further discussion differing with the limits-to-growth advocates, see Heilbroner, *supra*; Mason, *Resources in the Past and for the Future*, in RESOURCES FOR AN UNCERTAIN FUTURE 13-17 (C. Hitch ed. 1978); Perlman, *Is the World Running Out of Raw Materials?*, 50 INT'L AFF. 416 (1974).

growing demand for natural resources, heightened by increased population pressure,²⁸ will produce devastating international effects.²⁹

The claim by "limits to growth" theorists that the industrialized world was in transition from an era of abundant raw material supplies to a period of scarcity has been criticized.³⁰ Nevertheless, there

²⁸ See *The U.S. Stake in the Global Economy: Hearings on the Implications for the United States of Trends and Interrelationships Between Population and Development in Developing Countries Before the Subcomm. on International Economic Policy of the House Comm. on Foreign Relations*, 97th Cong., 1st Sess. 113 (statement of Rep. James H. Scheuer, N.Y.).

Ninety percent of the population growth between now and the year 2000 will take place in the developing countries of the Third World. It will give these countries a cumulative job deficit by the year 2000 of over one billion jobs. It is impossible to produce one billion jobs in the developing world by the end of the century. Therefore, the staggering population increase will have severe international implications for the United States, especially in terms of illegal immigration. *Id.* In the next decade the United States must look forward to the prospect of instability on its southern border with Mexico. See Broyles, *The Key is Mexico, not Nicaragua*, U.S. NEWS & WORLD REP., Mar. 31, 1986, at 10; Castaneda, *Mexico's Coming Challenges*, 64 FOREIGN POL'Y 120 (Fall 1986); Cusack, *Defusing Mexico's Population Bomb*, SCHOLASTIC UPDATE, Feb. 21, 1986, at 118; Levy & Szekely, *Mexico: Challenges and Responses*, 85 CURRENT HISTORY 16 (Jan. 1986).

²⁹ One of the more extensive reports on the global condition is *The Global 2000 Report: Hearing Before the Subcomm. on International Economics of the Congressional Joint Economic Comm.*, 96th Cong., 2d Sess. 6 (1980) [hereinafter *Global 2000 Report*] (statement of Gus Speth, Chairman, Council on Environmental Quality). The *Global 2000 Report* is the result of an intense and wideranging government effort to examine the long-term implications of present global population, natural resource, and environmental trends. The major findings of the *Global 2000 Report* are highlighted in the first two paragraphs of the report:

If present trends continue, the world in 2000 will be more crowded, more polluted, less stable ecologically, and more vulnerable to disruption than the world we live in now. Serious stresses involving population, resources, and environment are clearly visible ahead. Despite greater material output, the world's people will be poorer in many ways than they are today.

For hundreds of millions of the desperately poor, the outlook for food and other necessities of life will be not better. For many it will be worse. Barring revolutionary advances in technology, life for most people on earth will be more precarious in 2000 than it is now—unless the nations of the world act decisively to alter current trends.

Id. For further discussion on the *Global 2000 Report*, see Speth, *The Global 2000 Report to the President*, 8 B.C. ENVTL. AFF. L. REV. 695 (1980).

For an interesting point, counterpoint on the *Global 2000 Report*, see Simon, *Global Confusion, 1980: A Hard Look at the Global 2000 Report*, 62 PUB. INTEREST 3 (Winter 1981); Gillman, *Julian Simon's Cracked Crystal Ball*, 65 PUB. INTEREST 71 (Fall 1981); Simon, *False Bad News Is Truly Bad News*, 65 PUB. INTEREST 80 (Fall 1981).

³⁰ Murphy, *A Report on the Potential for Supply Dislocation of Selected Nonenergy Materials*, in SPECIAL STUDY ON ECONOMIC CHANGE, 96TH CONG., 2D SESS. ENERGY AND MATERIAL: A SHORTAGE OF RESOURCES OR COMMITMENT? 185, 186 (Comm. Print 1980). See also Goeller & Zucker, *Infinite Resources: The Ultimate Strategy*, 223 SCI. 456 (Feb. 3, 1984). Goeller and Zucker believe that the world contains plentiful nonfuel minerals that can supply mankind's long-term needs at reasonable cost and with acceptable environmental consequences provided there are "stable political conditions, . . . continuing availability of capital, and, most importantly, vigorous and successful research in the field of materials." Goeller & Zucker, *supra*, at 456.

have been important changes in world raw material markets that have affected United States interests.³¹ The United States faces increased competition for nonfuel minerals from developing and other industrialized countries as their economies grow and standards of living rise.³² Compounding the problem, easily found mineral deposits are being depleted, ore grades are declining, and mining costs are increasing.³³ As a result, the United States has become increasingly dependent upon foreign supplies for basic nonfuel mineral needs³⁴ and consequently has an annual trade deficit of one billion dollars in basic raw materials.³⁵

B. Strategic and Critical Minerals and Materials

There are four major factors that make a mineral a strategic resource: (1) the critical need for the mineral in defense or industry such that a prolonged interruption would result in catastrophic consequences; (2) the lack of adequate domestic resources; (3) the limited potential for developing substitutes; and (4) the lack of alternative or more secure sources of supply.³⁶

³¹ Murphy, *supra* note 30, at 186.

³² CONGRESSIONAL HANDBOOK, *supra* note 18, at 28. While United States consumption of nonfuel minerals is increasing in absolute terms, the percent of consumption has declined from 60% in 1950 to less than 30% in 1981 of the world total. *Id.*

³³ *Id.* at 24. See H.R. REP. NO. 1442, 91st Cong., 2d Sess. 2, reprinted at 1970 U.S. CODE CONG. & ADMIN. NEWS 5792, 5793 [hereinafter H.R. REP. NO. 1442]; see also *The Death of Mining*, BUS. WK., Dec. 17, 1984, at 64, 65, 67.

³⁴ 50 U.S.C. app. § 2169(b)(1) (1982).

³⁵ CONGRESSIONAL HANDBOOK, *supra* note 18, at 14; Clark & Field, *How Critical are Critical Materials?*, 88 TECH. REV. 38 (Aug./Sept. 1985).

³⁶ CONGRESSIONAL HANDBOOK, *supra* note 18, at 129, 344-49.

There is no universally accepted definition of the term "strategic and critical materials." It depends upon the purpose of the definition. TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 45. For purposes of a national materials stockpile, the term "strategic and critical materials" is defined in the context of a hypothetical cut off of foreign mineral supplies during a three year national emergency. 50 U.S.C. § 98a(b), 98b(b)(a)(2) (1982). The Strategic and Critical Materials Stockpiling Revision Act of 1979, 50 U.S.C. §§ 98-100a (1982), defines the term "strategic and critical materials" as "materials that (A) would be needed to supply the military, industrial, and essential civilian needs of the United States during a national emergency, and (B) are not found or produced in the United States in sufficient quantities to meet such need." 50 U.S.C. § 98h-3(1) (1982).

For the purpose of this study the term "strategic" refers to the likelihood that the future supply of a particular mineral to the United States may be interrupted, while "critical" refers to the importance of the mineral to the United States economy. GENERAL ACCOUNTING OFFICE, REPORT TO THE SECRETARY OF THE INTERIOR, ACTIONS NEEDED TO PROMOTE A STABLE SUPPLY OF STRATEGIC AND CRITICAL MINERALS AND MATERIALS 5-6 (June 3, 1982) [hereinafter ACTIONS TO PROMOTE A STABLE SUPPLY OF MINERALS]. Thus, a strategic material may be briefly defined as "one for which the quantity required for essential civilian

Table 3 lists twelve minerals and materials that are essential to the United States economy and whose supply is relatively limited and vulnerable to interruption. The table also lists major foreign sources, mineral usage, and United States import reliance as a percent of apparent consumption. While all of the minerals listed in Table 3 are considered essential to the domestic economy and national security, four of them—chromium, cobalt, manganese, and platinum—have been referred to as “first tier” strategic materials because of their widespread role and vulnerability to supply disruptions.³⁷ The remaining eight, while all essential to the United States economy, form a second tier of strategic materials because of their more limited roles.³⁸ Table 4 shows the 1980 distribution of consumption of the four first tier minerals over the major industrial sectors in the United States.

1. Chromium

Chromium has a variety of applications throughout the United States economy,³⁹ the most essential of which are superalloys,⁴⁰ stainless steel, and as an alloying element in tool, spring, and bearing steels.⁴¹ There is no known substitute for chromium in stainless

and military uses exceeds the reasonably secure domestic and foreign supplies, and for which acceptable substitutes are not available within a reasonable period of time.” *TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY*, *supra* note 4, at 11.

³⁷ *TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY*, *supra* note 4, at 11.

³⁸ *Id.*

³⁹ *CONGRESSIONAL HANDBOOK*, *supra* note 18, at 135.

⁴⁰ Chromium is combined with nickel, cobalt, aluminum, and titanium to give superalloys corrosion and oxidation resistance at high temperatures and stress. Alloy steels would fail under these conditions because of creep, defined as the “gradual deformation of a material when it is subjected to stress at high temperature,” or to rapid corrosion by the hot exhaust gases of a jet engine. These materials therefore are essential to the construction of gas turbine engines. *TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY*, *supra* note 4, at 12–13, 63. “The manufacture of superalloys accounts for a majority of the total domestic consumption of chromium metal. In 1981, consumption of metallic chromium in superalloys was 2,500 short tons or 64 percent of the total domestic consumption of chromium metal.” *Id.* at 63.

⁴¹ *Foreign Metals*, *supra* note 8, at 74; *TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY*, *supra* note 4, at 12, 65. As an alloying element, chromium increases hardness and impact strength of steel and provides resistance to oxidation, corrosion, and wear. *CONGRESSIONAL HANDBOOK*, *supra* note 18, at 135. As an important ingredient in stainless steel and super alloys, chromium is essential in chemical processing applications, oil and gas production and refining, power generation, jet engines, and in automobile exhaust systems, principally in the catalytic conversion. *TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY*, *supra* note 4, at 63–66. Chromium in its mineral form of chromite is used in making refractory bricks to line furnaces, steam generators, fireboxes, and ladles for molten steel. *Id.* In a chemical form it is used in pigments, metal treatments, and leather tanning.

steels and high temperature resistant superalloys.⁴² Therefore, it is most essential to modern industrial needs.⁴³

The United States produces insignificant amounts of chromite (chrome ore).⁴⁴ The world's major chromium deposits are located in southern Africa (South Africa and Zimbabwe) and the Soviet Union. In 1984, imports accounted for eighty-two percent of chromium consumption in the United States,⁴⁵ with South Africa accounting for fifty-nine percent.⁴⁶ Other major suppliers to the United States are the Philippines, Madagascar, Finland, Turkey, and the Soviet Union.⁴⁷ The security of supply lines from the politically troubled southern African region is a major concern.⁴⁸ Expanded reliance upon the Soviet Union could create a dangerous and costly dependence in times of national emergency.⁴⁹ A National Materials Advi-

⁴² *Id.* at 53; CONGRESSIONAL HANDBOOK, *supra* note 18, at 135.

⁴³ TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 53.

What is important about chrome anyway? . . . [I]f the U.S. producers do not receive chrome and cobalt, of which we have none, we will not be able to fly a jet airplane, . . . build a car, run a train, build an oil refinery, build a power station, nuclear or conventional, [or] process foods

. . . We are going to have to shut down our hospitals unless you want to be operated on a wood table with a rusty knife. You cannot build a computer, cannot build a computer tool, . . . cannot build magnets so you would have to, therefore, close down most of our communications systems in the country and you could not process crude oil. That is just to mention a couple of minor things we would have to do without if we do not get chrome and cobalt under today's technology.

Nonfuel Minerals Policy Review: Oversight Hearings on Nonfuel Minerals Policy Review Before the Subcomm. on Mines and Mining of the House Comm. on Interior and Insular Affairs, Part II, 96th Cong., 1st Sess. 44 [hereinafter *Nonfuel Minerals Policy Review, Part II*] (statement of E.F. Andrews, Vice President, Materials and Services, Allegheny-Ludlum Industries, Inc.).

⁴⁴ Murphy, *supra* note 30, at 198. There has been insignificant amounts of domestic mine production of chromium since 1961. TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 138. United States chromium deposits are mostly in the Stillwater Complex in Montana, with additional but smaller deposits in California, Alaska, and Oregon. *Id.* at 53-54, 151-53. These deposits are limited and low grade, and, therefore, "are not considered close to being economically mineable at present." *Id.* at 54. For a discussion on United States domestic production prospects for chromium, see *id.* at 148-59.

⁴⁵ *Foreign Metals*, *supra* note 8, at 74. Since there is almost no domestic mine production of chromite, foreign sources supply nearly all of the United States requirements for chromium. TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 138. Recycling of scrap provides the United States with the remainder of its chromite needs. *Id.* at 53. Recycling accounted for approximately 18% of United States 1984 apparent consumption. *Foreign Metals*, *supra* note 8, at 74.

⁴⁶ TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 53-54.

⁴⁷ *Id.* at 54. The major world suppliers of chromite to the United States in 1982 were: South Africa (59%), Phillipines (11%), Madagascar (9%), Finland (7%), Turkey (6%), Soviet Union (6%), and Albania (1%). *Id.*

⁴⁸ CONGRESSIONAL HANDBOOK, *supra* note 18, at 136.

⁴⁹ *Id.*; 50 U.S.C. § 98a(b) (1982); 50 U.S.C. app. § 2181 (1982). While South Africa has the

sory Board Study concluded that the United States "is strategically more vulnerable to a long-term chromium embargo than to an embargo of any other natural resource, including petroleum."⁵⁰

2. Cobalt

Cobalt is crucial to the United States because of its many military and industrial uses⁵¹ for which substitution is difficult.⁵² The principal use of cobalt is in superalloys that require high strength and very high temperatures.⁵³

The United States does not produce cobalt.⁵⁴ In 1984, the United States was dependent on imports for ninety-five percent of its cobalt

world's largest chromite reserves, the Soviet Union is actually the world's largest producer of chromium. *TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY*, *supra* note 4, at 139. The Soviet Union once played a significant role in supplying the United States with chromium ore. Since the mid-1970's, however, its contribution to United States supplies has declined significantly. The Soviet Union currently exports nearly all of its chromite production to the Eastern bloc. The major reasons that have been suggested for the change in Soviet exports of chromium ore are "[d]ecreasing reserves, increased costs of production, and political control over export policies" *Id.* at 138. For a discussion on foreign production of chromium, see *id.* at 137-48.

⁵⁰ CONGRESSIONAL HANDBOOK, *supra* note 18, at 136.

⁵¹ *Id.* at 133. In 1982, the National Materials Advisory Board estimated that 50% of the consumption of cobalt was essential. *TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY*, *supra* note 4, at 67.

⁵² *TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY*, *supra* note 4, at 54, 66. See also Murphy, *supra* note 30, at 199.

⁵³ *TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY*, *supra* note 4, at 54. In 1980, superalloys accounted for 6.3 million pounds or 41 percent of United States cobalt consumption. It is projected that 8.3 million pounds of cobalt will be used in the United States in the production of superalloys in 1995, and 12.9 million pounds of cobalt will be required to meet domestic needs in 2010. *Id.* at 67.

The aviation industry, therefore, is critically dependent upon cobalt alloys which are used in jet engines to withstand high temperatures. The F-100 engine, used in F-15 and F-16 fighter aircraft, contains approximately 150 pounds of cobalt. *Id.* Because of its unique hardening qualities and resistance to corrosion and abrasion, cobalt is required in the manufacture of machine tools and bits, as a binder in cement carbides for metal cutting, and as a catalyst in petroleum refining to remove sulfur and heavy metals from petroleum. Murphy, *supra* note 30, at 199; *TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY*, *supra* note 4, at 67-68. Cobalt is also used in electrical equipment where its strong magnetic properties make small, powerful, and long-lasting magnets. *Id.* at 69-70.

⁵⁴ *TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY*, *supra* note 4, at 167. Currently, cobalt is not produced from domestic mines in the United States. Domestic deposits have been mined in the past and in 1958 reached a high yield of approximately 4.8 million pounds of cobalt. *Id.* The United States has large cobalt deposits, particularly at the Blackbird Mine in Idaho and the Madison Mine in Missouri. Substantial cobalt is also associated with copper-nickel deposits in the Duluth Gabbro of Minnesota and Gasquet Mountain in California. These reserves cannot be mined economically at the current world price of cobalt without government assistance. *Id.* at 167-73. See also Murphy, *supra* note 30, at 199.

needs,⁵⁵ with recycling of purchased scrap supplying the balance.⁵⁶ The largest supply sources of both for the United States and the rest of the free world are Zaire and Zambia.⁵⁷ In 1982, Zairian cobalt accounted for thirty-nine percent of United States imports, and Zambia nine percent.⁵⁸ These two southern African nations have the largest and richest cobalt reserves⁵⁹ and are expected to dominate the world's cobalt supply far into the next century.⁶⁰ Exports of Zairian cobalt to the United States are vulnerable to supply interruption due to political instability, the breakdown of old equipment, and because of Zaire's "reliance on a complicated road, rail, and water transport system from point of production to port of export."⁶¹

3. Manganese

The principal use of manganese is in steel production, which accounts for approximately ninety percent of United States manganese consumption.⁶² Currently, no practicable alternatives to the use of manganese in steelmaking are available.⁶³

No manganese ore is produced domestically.⁶⁴ The United States imported ninety-nine percent of its supply in 1984.⁶⁵ Domestic re-

⁵⁵ *Foreign Metals*, *supra* note 8, at 74.

⁵⁶ TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 54, 159 (1982 figures).

⁵⁷ *Id.* at 159. In 1982, Zaire produced about 45% of the world's cobalt supply and Zambia contributed 13%. *Id.*

⁵⁸ *Id.* at 55.

⁵⁹ *Id.* at 54-55, 160.

⁶⁰ *Id.* at 54-55. For a discussion on foreign production of cobalt, see *id.* at 160-67.

⁶¹ Murphy, *supra* note 30, at 199.

⁶² TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 55, 71. The remainder is used in batteries and chemicals. *Id.* at 71. When iron is converted to steel, manganese must be added to remove the sulfur. *Id.* at 55. As an alloying element, manganese is also added to steel to impart strength and hardness. *Id.* at 55, 71.

⁶³ *Id.* at 55. See also Murphy, *supra* note 30, at 202.

⁶⁴ TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 55. The last year of production of manganese ore in the United States was 1970. Historically, domestic production of manganese has contributed to United States requirements. The United States was self-sufficient in manganese during the last half of the 19th century. Since 1900, however, domestic production of manganese has not been able to keep up with the needs of the United States steel industry and other demands. United States production of manganese has steadily declined, even in wartime, from 23% of consumption during World War I, 13% during the Second World War, and only 8% during the Korean Conflict. Today, the prospects for production of manganese from United States deposits is highly unlikely because domestic manganese resources of significant size are very low in grade and too costly to exploit commercially at current prices. *Id.* at 184-86.

⁶⁵ *Foreign Metals*, *supra* note 8, at 74. The United States produces only one percent of manganese ore from domestic production of manganiferous ores that contain less than 35% manganese. TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 55.

cycling of manganese from scrap materials is insignificant.⁶⁶ The Soviet Union and South Africa have the largest manganese deposits in the world.⁶⁷ Together, these two nations produced sixty-four percent of total world manganese production in 1982.⁶⁸ The largest suppliers of manganese ore to the United States are South Africa and Gabon. In 1982, South Africa accounted for fifty-two percent while Gabon supplied twenty-one percent of United States requirements.⁶⁹ All major sources of supply require long-distance transportation by sea, causing supply stability concern to the United States. This method of transport increases the vulnerability to supply interruption in the case of world conflict, political instability, or military interference with shipping.⁷⁰

4. The Platinum Group Metals

The platinum group metals include six metals which have similar properties. These metals are platinum, palladium, rhodium, iridium, osmium, and ruthenium.⁷¹ These are among the scarcest of minerals and have become vital to modern industrial production because of their unique properties⁷² and stability in extreme environments.⁷³

⁶⁶ CONGRESSIONAL HANDBOOK, *supra* note 18, at 138.

⁶⁷ TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 55, 178. The Soviet Union and South Africa are not the only countries with large manganese deposits. Australia and Gabon contain substantial reserves of manganese ore "which could last a century or more at the current rate of production." *Id.* at 55-56.

⁶⁸ *Id.* at 177. In 1982, the Soviet Union accounted for 41 percent and South Africa 23 percent of total world manganese production. *Id.* at 178. The five nations of Gabon, Australia, Brazil, India, and China each made a significant contribution of over one million short tons of manganese ore in 1982. *Id.* at 177-78. For a discussion on foreign productions of manganese, see *id.* at 177-84.

⁶⁹ *Id.* at 56.

⁷⁰ *Id.* at 55-56. See also 50 U.S.C. app. § 2181 (1982) (general discussion of United States' vulnerability in its reliance on importation of critical minerals). CONGRESSIONAL HANDBOOK, *supra* note 18, at 139 ("Of strategic concern is that the United States depends on only a few nations for most of its manganese.").

⁷¹ CONGRESSIONAL HANDBOOK, *supra* note 18, at 139.

⁷² *Id.*

⁷³ TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 72. Platinum group metals catalyze many chemical reactions and are resistant to high temperatures and chemical attack. They are essential in catalytic applications in petroleum refining, chemical processing, and in the treatment of exhaust gas from automobile engines. *Id.* at 56, 72-74. The major consumption of platinum in the United States is in automobile catalytic converters, for which there is no satisfactory substitute. *Id.* at 56. The platinum group metals are also used as corrosion resistant materials in many uses, including contacts in telecommunication equipment, electrodes in ceramic capacitors, jewelry, and medical and dental equipment. *Id.* at 56, 72-77. See also CONGRESSIONAL HANDBOOK, *supra* note 18, at 139.

As with manganese, the principal producers of the platinum group metals are the Soviet Union and the Republic of South Africa.⁷⁴ Mines in these two nations accounted for nearly ninety-five percent of the world's production of platinum group metals in 1982, and this production pattern is likely to continue in the future.⁷⁵ In 1984, the United States imported ninety-one percent of the platinum group metals it consumed.⁷⁶ With the largest source originating in South Africa, followed by the Soviet Union,⁷⁷ the United States' dependency on these two countries for imports of platinum group metals is a matter of strategic concern.⁷⁸

Clearly, the nation's mineral security has become increasingly dependent on potentially unreliable foreign sources of supply.⁷⁹ The dependence of the United States on foreign sources of nonfuel minerals is a significant factor in the national balance-of-payments deficit, contributes to the loss of domestic employment, exposes the nation to supply disruption, and poses a risk to national security.⁸⁰ To some observers, United States reliance on imports of foreign minerals constitutes a dangerous dependency, threatening a materials crisis more devastating than the recent energy crisis.⁸¹

⁷⁴ TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 192. While the Soviet Union is presently the world's largest producer of platinum group metals, its reserves are only one-fifth the size of those of South Africa. *Id.* at 57.

⁷⁵ *Id.* at 191-92. In 1982, the world depended on the Soviet Union for 54% of its platinum needs and on South Africa for 40%. *Id.* at 192. For a discussion on foreign production of platinum group metals, see *id.* at 190-95.

⁷⁶ *Foreign Metals*, *supra* note 8, at 74. The United States is virtually entirely dependent upon foreign imports for new supplies of platinum group metals. Domestic mine production supplies less than one percent of the nation's requirements, the remaining demand for platinum metals is supplied from recycled materials. TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 57. See also CONGRESSIONAL HANDBOOK, *supra* note 18, at 139-40. Unlike the other first tier minerals, the United States is a minor producer of platinum group metals as a byproduct of copper mining. Platinum group metal deposits are located in Montana, Alaska, and Minnesota. TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 196-200.

⁷⁷ TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 57.

⁷⁸ CONGRESSIONAL HANDBOOK, *supra* note 18, at 140. See also Murphy, *supra* note 30, at 203.

⁷⁹ 50 U.S.C. app. § 2181 (1982); 50 U.S.C. §§ 98a(b) (1982); 30 U.S.C. § 1401(a)(2) (1982); 30 U.S.C. § 1801(a)(2) (Supp. III 1985).

⁸⁰ S. REP. NO. 897, *supra* note 2, at 2, reprinted in 1980 U.S. CODE CONG. & ADMIN. NEWS, at 4872. See also, *supra* note 79. Experts have estimated that by the year 1990, 50% or more of all United States metal requirements will be imported, resulting in an annual trade deficit of over \$100 billion based on 1980 prices. *Nonfuel Minerals Policy Review, Part II*, *supra* note 43, at 44 (statement of E.F. Andrews, Vice President, Materials and Service, Allegheny-Ludlum Industries, Inc.).

⁸¹ Holden, *supra* note 7, at 305. See also Cook, *The Crisis that Didn't Happen*, FORBES, Nov. 22, 1982, at 91.

III. GOVERNMENT POLICY AND ONSHORE MINERALS AVAILABILITY

A. Federal Policies in General

The abundant mineral resources of the United States have contributed to the development of an industrialized economy and a high standard of living.⁸² Historically, government policies have encouraged access to federal lands for the development of domestic energy

Some commentators have argued that the "minerals crisis" is overblown, and is not likely to occur. See generally Cook, *supra*; Polsgrove, *Strategic Minerals: Reality and Ruse*, SIERRA, July/Aug. 1982, at 28; Shafer, *Mineral Myths*, 47 FOREIGN POLICY 154 (1982). They maintain that the United States has always been dependent on imports for a large share of its material needs and such reliance is a small share of the nation's total gross national product. Cook, *supra*, at 94. They also assert that the strategic minerals problem has been utilized by the mining industry and the Reagan administration to justify easing the environmental regulations related to mining and processing and opening large areas of federal land, including wilderness areas, to mining exploration. Polsgrove, *supra*, at 28. Moreover, "mineral myth" advocates note that the United States spends "only about \$80 for each person in the country each year for the raw materials for all the metals the country uses." Singer, *How Dependent Is U.S. on Strategic Minerals?*, Wall St. J., Aug. 14, 1986, at 16, col. 3.

It is generally accepted that the United States is and will continue to be import dependent on some minerals and materials, and because of this reliance the United States is vulnerable to supply disruptions. See *supra* note 79; ACTIONS TO PROMOTE A STABLE SUPPLY OF MINERALS, *supra* note 36, at 3. The consequences of a prolonged supply shortage of strategic and critical minerals would be severe.

In today's technological society, the United States and the other industrialized nations of the world could not build a jet engine or an automobile, run a train, build an oil refinery, or construct a nuclear or conventional power station without adequate supplies of materials for which the United States is virtually 100 percent dependent on imports. We could not process food under our present laws, comply with our clean air and water laws, or meet sanitary hospital codes. We could not build computers, cutting tools, mining tools, magnets, or process crude oil, just to mention a few examples of the potential impact of supply disruptions. An adequate and stable supply of these materials is as vital to the industrial and economic health of the nation as nutrition is to the human body.

S. REP. NO. 897, *supra* note 2, at 4, reprinted in 1980 U.S. CODE CONG. & ADMIN. NEWS, at 4874.

⁸² S. REP. NO. 897, *supra* note 2, at 1, reprinted in 1980 U.S. CODE CONG. & ADMIN. NEWS, at 4872. See also TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 5; CONGRESSIONAL HANDBOOK, *supra* note 18, at 351; GENERAL ACCOUNTING OFFICE, REPORT TO THE CONGRESS, THE U.S. MINING AND MINERAL-PROCESSING INDUSTRY: AN ANALYSIS OF TRENDS AND IMPLICATIONS I (Oct. 31, 1979) [hereinafter AN ANALYSIS OF THE U.S. MINING INDUSTRY].

Three factors contribute to the United States' heritage of abundant natural resources. First, the United States covers a very large land mass that includes a wide range of geological diversity. Second, the United States has a low population density which allows for large open spaces. Finally, as a result of the geographic scope and low population density, the United States has a favorable ratio of domestic resources to population that is available to most of its citizens. CONGRESSIONAL HANDBOOK, *supra* note 18, at 351.

and mineral resources to contribute to the nation's economic and industrial growth.⁸³ On the other hand, in the last twenty-five years, public interest in protecting and preserving surface resources on federal lands has grown.⁸⁴ In the 1970s and into the 1980s, federal efforts to protect the environment and to preserve cultural and aesthetic resources increased.⁸⁵ Some government policies, including those of local government⁸⁶ and Indian tribes,⁸⁷ designed to protect environmental resources have restricted access to federal lands for domestic mineral exploration and development.⁸⁸ Therefore, such federal decisions as wilderness and national monument designations, though not normally characterized as mineral decisions, have major consequences for mineral policy because these single-use designations exclude access to federal lands, add costs to development, and increase uncertainty in the effort to explore mineral resources.⁸⁹

Over the past decade mineral resource development in the United States has become increasingly dependent upon decisions of a government that is, according to a congressional report, "increasingly opposed to such development."⁹⁰ The major decisions of the federal government that affect domestic mineral development include public land access restrictions, environmental, health and safety regulations, antitrust enforcement, capital formation, and tax policy.⁹¹ The nation's supply of mineral resources "has thereby become dependent not upon the free market system but upon the political process."⁹² As a result, mineral development in the United States has become difficult, time consuming, costly, and frequently impossible.⁹³

B. Restrictions to Public Lands Access

The government action that has most significantly impeded domestic mineral production has been the restriction of access to fed-

⁸³ P. GATES, HISTORY OF PUBLIC LAND LAW DEVELOPMENT 765 (1968).

⁸⁴ *Nonfuel Minerals Policy Review, Part I*, *supra* note 18, at 94 (statement of Charles D. Hylander, Deputy Director, International Division, United States General Accounting Office).

⁸⁵ Glaiser, *Cultural Resource Preservation: A Consideration Before Mineral Development*, 28 ROCKY MTN. MIN. L. INST. 635 (1983).

⁸⁶ Barnhill, *The Role of Local Government in Mineral Development*, 28 ROCKY MTN. MIN. L. INST. 221 (1983); U.S. MINERALS VULNERABILITY REPORT, *supra* note 19, at 27.

⁸⁷ Moore, *Mineral Development on Indian Lands—Cooperation and Conflict*, 28 ROCKY MTN. MIN. L. INST. 1 (1983).

⁸⁸ U.S. MINERALS VULNERABILITY REPORT, *supra* note 19, at 27.

⁸⁹ See AN ANALYSIS OF THE U.S. MINING INDUSTRY, *supra* note 82, at 1, 18–20.

⁹⁰ U.S. MINERALS VULNERABILITY REPORT, *supra* note 19, at 27.

⁹¹ See generally *id.*

⁹² *Id.*

⁹³ *Id.*

eral lands for mineral exploration and development.⁹⁴ Currently the federal government owns approximately 732 million acres, or about one-third of the land in the United States.⁹⁵ The federal government also retains control over the subsurface mineral rights of an additional sixty-three million acres⁹⁶ and has jurisdiction over approximately one billion acres of offshore lands on the nation's outer continental shelf.⁹⁷ Over ninety percent of the federal onshore land is located in the eleven contiguous western states and Alaska,⁹⁸ whose public lands are the best hope for significant mineral discoveries.⁹⁹

Federal lands are an essential part of the national mineral and energy base.¹⁰⁰ The American Petroleum Institute estimated that federal lands contain thirty-seven percent of the nation's undiscovered crude oil, forty-three percent of the undiscovered natural gas, forty percent of the coal reserves, eighty percent of the recoverable oil shale reserves, and ninety-five percent of the tar sand deposits.¹⁰¹ Despite this optimistic appraisal of the public lands' mineral resource potential, in 1980 only about thirteen percent of federal onshore lands were under lease for oil and gas exploration and development.¹⁰²

⁹⁴ Note, *United States Minerals Policy—A Proposal to Revitalize the Exploration and Development of Domestic Mineral Resources*, 24 ARIZ. L. REV. 881 (1982). See also AN ANALYSIS OF THE U.S. MINING INDUSTRY, *supra* note 82, at 18.

⁹⁵ BUREAU OF LAND MANAGEMENT, PUBLIC LAND STATISTICS 1984 10 (1985) [hereinafter PUBLIC LAND STATISTICS 1984]. See also AN ANALYSIS OF THE U.S. MINING INDUSTRY, *supra* note 82, at 19.

⁹⁶ *Withdrawal of Certain Lands from Mineral Leasing: Hearings on S. 2801 and H.R. 6542 Before the Subcomm. on Public Lands and Reserved Water of the Senate Comm. on Energy and Natural Resources*, 97th Cong., 2d Sess. 150 (1982) [hereinafter *Hearings on S. 2801*] (statement of James Cook, District Landsman, Placid Oil Co.).

⁹⁷ Jones, *The Development of Outer Continental Shelf Energy Resources*, 11 PEPPERDINE L. REV. 9, 11 n.6 (1983). The outer continental shelf is the submerged lands on the continental margins of the United States which are subject to federal jurisdiction. These lands lie outside the three-mile zone of coastal submerged lands which are reserved to the states. See 43 U.S.C. § 1331(a) (1982).

⁹⁸ See PUBLIC LANDS STATISTICS 1984, *supra* note 95, at 10.

The amount of federally owned land in each state is graphically demonstrated by Table 5.

⁹⁹ U.S. MINERALS VULNERABILITY REPORT, *supra* note 19, at 59. The mineral wealth contained within western public lands is illustrated by the fact that Arizona contains 65% of United States estimated copper reserves, but 70% of the state's land is owned by the Federal Government. AN ANALYSIS OF THE U.S. MINING INDUSTRY, *supra* note 82, at 19.

¹⁰⁰ See, e.g., Boskin, Robinson, O'Reilly, & Kumar, *New Estimates of the Value of Federal Mineral Rights and Land*, 75 AM. ECON. REV. 923 (1985). The value of federal land and oil and gas mineral rights is substantial. In 1981, these estimates were \$175 billion and \$819 billion, respectively. *Id.* at 934.

¹⁰¹ *Hearings on S. 2801*, *supra* note 96, at 150 (statement of James Cook, District Landsman, Placid Oil Co.).

¹⁰² *Id.*

A 1977 Interior Department report concluded that forty-two percent of public lands are closed to mineral activity, sixteen percent are severely restricted, and another ten percent are moderately restricted.¹⁰³ Thus, approximately seventy percent of federal lands have been withdrawn from mineral access. In the eleven western states, approximately forty-four percent of federal lands are closed to mineral leasing.¹⁰⁴ At one time in our nation's history, ninety percent of all federal lands were available for mineral exploration and development.¹⁰⁵

Much of the restricted access to mining activity results from the designation of increasing amounts of public lands as wilderness areas.¹⁰⁶ Such designations exclude access, add costs, and increase the uncertainty of efforts to find and produce minerals.¹⁰⁷ The po-

¹⁰³ U.S. MINERALS VULNERABILITY REPORT, *supra* note 19, at 60-61. An update study has not been made. It is estimated, however, that public lands now closed or restricted to mining have increased by 10 to 15%. *Id.* at 60.

¹⁰⁴ *Hearings on S. 2801*, *supra* note 96, at 191-92 (statement of Alfred H. Voelker, Research Staff, MBR, Resource Analysis Group, Oak Ridge National Laboratories).

At the present time, it is estimated that in the eleven contiguous Western states, 6% of federal public lands are formally closed to mining, 38% are highly restricted, and 56% are open with moderate or slight restrictions. *Id.* at 191. Experts have concluded that by 1990 the availability of western federal lands for mineral leasing will increase to about 70%. The availability of public lands will rise because many of the present restrictions are temporary and will be removed in the 1980s. Many of the restrictions on western federal lands are the result of planning programs implemented in the past two decades. These programs require that public lands being studied for possible wilderness designation be managed so as to preserve their wilderness characteristics. During the 1980s, it is expected that most of these land use decisions will have been made, and millions of acres of public land that is presently restricted will be open to mineral exploration. *Id.* at 191-92. The process of declassifying wilderness study areas has not occurred as rapidly or thoroughly as these experts had planned. The wilderness system has increased nearly 800% from what was originally contemplated by Congress when it passed the Wilderness Act in 1964. *Id.* at 99 (statement of David F. Work, Exploration Manager, Western Region, Amoco Production Co., U.S.A.).

Significant amounts of public lands are also closed to oil and gas leasing. The General Accounting Office estimated that out of 410 million acres the Federal Government controls in the Lower 48 States, approximately 64 million acres are closed to oil and gas leasing. As much as 55% of these withdrawn lands were estimated to contain recoverable reserves of oil and gas. *Id.* at 2, 21.

¹⁰⁵ NEED FOR NATIONAL MATERIALS POLICY & PLANNING, *supra* note 4, at 29.

¹⁰⁶ See National Wilderness Preservation System Act, 16 U.S.C. §§ 1131-1136 (1982 & Supp. III 1985). Commercial mining activities are prohibited in wilderness areas. *Id.* §§ 1131(c), 1133(c). For discussion on wilderness policies and their effect on mineral development on public lands, see Short, *Wilderness Policies and Mineral Potential on the Public Lands*, 26 ROCKY MTN. MIN. L. INST. 39 (1980); Hall, *Mineral Exploration and Development in Bureau of Land Management Wilderness Study Areas*, 21 ARIZ. L. REV. 351 (1979); and Watson, *Mineral and Oil and Gas Development in Wilderness Areas and Other Specially Managed Federal Lands in the United States*, 29 ROCKY MTN. MIN. L. INST. 37 (1983).

¹⁰⁷ See Bennett, *Public Land Policy: Reconciliation of Public Use and Private Development*, 11 ROCKY MTN. MIN. L. INST. 311 (1966); Loesch, *Multiple Uses of Public Lands—Accom-*

tential size of the National Wilderness Preservation System is huge. Currently over eighty million acres of land are designated as wilderness, and an additional 149 million acres have been set aside as wilderness study or candidate areas.¹⁰⁸ The potential federal acreage devoted exclusively to preservation of wilderness values and withdrawn from mineral activity is approximately 229 million acres, or thirty-one percent of all federal lands, an area equal in size to California, Nevada, and Arizona combined.¹⁰⁹ The withdrawals that have had the most significant impact on potential domestic mineral production have occurred in Alaska, which contains "probably the most highly mineralized area in the United States [with] the potential for exploration beyond imagination."¹¹⁰ However, over 100 million acres in Alaska have been restricted from mineral exploration, and only seventeen percent of the state is actually open to mining.¹¹¹

Proposals to reduce restrictions on federal land use, including suggestions to authorize mineral leasing in wilderness areas, have resulted in public opposition.¹¹² There is strong public opinion that the last places the federal government should conduct mineral leasing is in wilderness areas.¹¹³ An interesting example of this debate is the controversy surrounding oil and gas exploration. Of the 137 million acres of federal land under lease in the lower 48 states, up to eighty percent of the leases will expire without any exploratory

odation or Choosing Between Conflicting Uses, 16 ROCKY MTN. MIN. L. INST. 1 (1971); and U.S. MINERALS VULNERABILITY REPORT, *supra* note 19, at 27.

Nevada State Senator Richard Blakemore testified before a congressional committee in 1980 that the major problem confronting the Nevada mining industry is the threat that additional lands will be declared wilderness areas, locking away forever without adequate explanation or inventory the resources located within those areas.

¹⁰⁸ *Hearings on S. 2801*, *supra* note 96, at 99 (statement of David F. Work, Exploration Manager, Western Region, Amoco Production Co., U.S.A.).

¹⁰⁹ *Id.*

¹¹⁰ *National Materials Policy: Hearing on H.R. 2743 Before the Subcomm. on Science, Technology, and Space of the Senate Comm. on Commerce, Science, and Transportation*, 96th Cong., 2d Sess. 82 (1980) (statement of Howard L. Edwards, General Attorney, Anaconda Copper Co.) [hereinafter *Hearings on H.R. 2743*].

¹¹¹ Velocci, *Minerals, The Resource Gap*, 68 NATION'S BUS. 33, 36 (1980). The restrictions on mineral development in Alaska are due mostly to the Alaska National Interest Lands Conservation Act (ANILCA), 16 U.S.C. §§ 3101-3233 (1982 & Supp. III 1985). ANILCA, as originally drafted by Representative Morris Udall, Chairman of the House Interior and Insular Affairs Committee, which had jurisdiction over Alaska land issues, excluded from mineral access approximately 70% of the highly favorable mineral areas in Alaska. *Nonfuel Minerals Policy Review, Part I*, *supra* note 18, at 85-86.

¹¹² H.R. REP. NO. 638, 97th Cong., 2d Sess. 4 (1982) [hereinafter H.R. REP. NO. 638].

¹¹³ *Id.*

drilling.¹¹⁴ Furthermore, it is estimated that wilderness areas and proposed wilderness areas contain only three percent of the nation's undiscovered oil resources and two percent of the undiscovered gas resources.¹¹⁵ Given these facts, opponents of federal leasing argue that the government should "simply refuse to issue leases in wilderness and wilderness candidate areas unless and until all existing leases are fully explored and developed."¹¹⁶

Increased access to public lands for mineral development is necessary if the United States is to reduce its reliance on foreign imports of strategic materials.¹¹⁷ National commissions that have studied domestic minerals policy have recommended increased mineral production from federal lands.¹¹⁸ Exploration of federal lands is needed to inject adequate mineral information into the decisionmaking process. Current mineral reserves estimates are too speculative to use as a basis to formulate public policy.¹¹⁹ Furthermore, the methods used in mineral exploration require access to large land areas in order to locate the relatively small areas with mineral potential.¹²⁰ "The probabilities are relatively strong that, when deposits are identified they will be on federal lands"¹²¹

In addition to withdrawing acreage from mineral development, wilderness designations have a "chilling" effect on industry acquisition of leasable properties close to a restricted wilderness area.¹²²

¹¹⁴ *Id.*

¹¹⁵ *Hearings on S. 2801*, *supra* note 96, at 182 (statement of Alfred H. Voelker, Research Staff, MBR, Resource Analysis Group, Oak Ridge National Laboratories).

¹¹⁶ H.R. REP. NO. 638, *supra* note 112, at 4-5.

¹¹⁷ *Hearings on H.R. 2743*, *supra* note 110, at 85 (statement of Howard L. Edwards, General Attorney, Anaconda Copper Co.); *id.* at 89 (statement of Richard Barrett, Dresser Minerals Division, Dresser Industries, Inc.).

¹¹⁸ U.S. MINERALS VULNERABILITY REPORT, *supra* note 19, at 58-59. *See also* PUBLIC LAND LAW REVIEW COMMISSION, ONE THIRD OF THE NATION'S LAND, A REPORT TO THE PRESIDENT AND TO THE CONGRESS 121-38 (1970) [hereinafter ONE THIRD OF THE NATION'S LAND].

¹¹⁹ AN ANALYSIS OF THE U.S. MINING INDUSTRY, *supra* note 82, at 19; ONE THIRD OF THE NATION'S LAND, *supra* note 118, at 123. The amount and quality of minerals resources information has frequently been described as limited and superficial. AN ANALYSIS OF THE U.S. MINING INDUSTRY, *supra* note 82, at 19; ONE THIRD OF THE NATION'S LAND, *supra* note 118, at 123. The very nature of lands suitable for wilderness designation—areas "untrammelled by man"—means that they are the least explored of all federal lands. *See* 16 U.S.C. § 1131(c) (1982).

¹²⁰ AN ANALYSIS OF THE U.S. MINING INDUSTRY, *supra* note 82, at 19.

¹²¹ *Id.*

¹²² *Sagebrush Rebellion: Impacts on Energy and Minerals: Oversight Hearing Before the Subcomm. on Mines and Mining of the House Comm. on Interior and Insular Affairs*, 96th Cong., 2d Sess. 160-61 (1980) [hereinafter *Sagebrush Rebellion Hearing*] (statement of Gordon

Federal agencies are also closing public lands to mineral activity through management decisions under the Federal Land Policy and Management Act (FLPMA).¹²³ As a result of FLPMA, the Department of the Interior has categorized no-leasing-decisions as administrative land management decisions rather than identifying them, as contemplated by the Act, as withdrawals.¹²⁴ The Interior Department does not maintain adequate records to identify the extent of its no-leasing administrative decisions.¹²⁵ There are also restrictions to mining in the National Parks.¹²⁶

The Public Land Law Review Commission stated in its 1970 report that "mineral exploration and development should have a preference over some or all other uses on much of our public lands."¹²⁷ Actual policy, however, has been to the contrary. "[A] functional bias exists at the federal level, in favor of preservation and against development of resources on the federal lands."¹²⁸ Indeed, "federal land use planning does not recognize the unique and essential nature of mineral development."¹²⁹ As a result of land withdrawals and the uncertainty over access to federal lands in the future, some mineral projects have closed or moved outside the United States.¹³⁰

L. Pine of Conoco). Conoco has refrained from obtaining mineral tracts close to a designated wilderness area, and "many . . . potential deposits will never be fully evaluated." *Id.* at 161.

¹²³ See 43 U.S.C. §§ 1701-1784 (1982 & Supp. III 1985); *Hearings on S. 2801*, *supra* note 96, at 21-22.

¹²⁴ *Hearings on S. 2801*, *supra* note 96, at 21-22.

¹²⁵ *Id.* at 22.

¹²⁶ See 16 U.S.C. §§ 1901-1912 (1982 & Supp. III 1985). The 1976 Mining in the Parks Act prohibited further mineral exploration in six National Park Service areas and placed environmental restrictions on development of existing mining claims in these areas. *Id.* For a discussion on mining on National Park Service Lands, see GENERAL ACCOUNTING OFFICE, REPORT TO THE CHAIRMAN, SUBCOMMITTEE ON MINES AND MINING, HOUSE COMMITTEE ON INTERIOR AND INSULAR AFFAIRS OF THE UNITED STATES, MINING ON NATIONAL PARKS SERVICE LANDS—WHAT IS AT STAKE? (Sept. 24, 1981); Novak, *Mining and the National Park Service*, 2 J. ENERGY L. & POL'Y 165 (1982).

¹²⁷ ONE THIRD OF OUR NATION'S LAND, *supra* note 118 at 122.

¹²⁸ Peck, "And Then There Were None," *Evolving Federal Restraints on the Availability of Public Lands for Mineral Development*, 25 ROCKY MTN. MIN. L. INST. 3-1, 3-13 (1979). It is important to note, however, that some observers have found the Reagan administration to be aggressively insensitive to the environment. One critic went so far as to call Reagan the "only openly anti-environmental president in our history." Oakes, *Reagan's Record of the Environment Fails to Match His Claims*, L.A. Daily J., Oct. 29, 1984, at 4, col. 3.

¹²⁹ *Hearings on H.R. 2743*, *supra* note 110, at 188 (statement of G.A. Barber, Vice President, Exploration and Geology, Anaconda Copper Co.).

¹³⁰ AN ANALYSIS OF THE U.S. MINING INDUSTRY, *supra* note 82, at 22; *Nonfuel Minerals Policy Review, Part II*, *supra* note 43, at 131 (remarks of Mr. Howard L. Edwards, General Counsel, Anaconda Copper Co., and Chairman, Committee on Public Lands, American Mining Congress). For example, St. Joe Minerals Company has relocated most of its mineral explo-

C. Environmental and Health and Safety Regulations

Federal law affects the minerals industries.¹³¹ Among significant regulatory laws are the General Mining Law of 1872,¹³² National Environmental Policy Act,¹³³ Clean Air Act,¹³⁴ Clean Water Act,¹³⁵ Resource Conservation and Recovery Act,¹³⁶ Occupational Safety and Health Act,¹³⁷ Mine Safety and Health Act,¹³⁸ Mine Reclamation Act,¹³⁹ and Federal Land Policy and Management Act.¹⁴⁰

These laws regulate the mining of raw materials, promote the safety of miners and plant workers, and minimize the environmental impacts associated with mining operations.¹⁴¹ These laws, however, impede domestic mineral production.¹⁴² While these laws have unquestioned social and economic importance, congressional testimony and studies have concluded that federal regulatory policies:

- (1) Have caused a rapid decline in the United States raw materials industry;
- (2) Have hindered the efficient production and fabrication of many industrial materials;
- (3) Have eroded the ability of the United States mining industry to contribute to the nation's security;
- (4) Have economically burdened basic industries such as metal extraction;
- (5) Have placed the United States materials industries at an unfair disadvantage to their foreign competitors;
- (6) Have contributed to low profitability in these industries;
- (7) Have discouraged new production;

ration from Alaska to Canada's Yukon Territory because of federal land access restrictions. AN ANALYSIS OF THE U.S. MINING INDUSTRY, *supra* note 82, at 22.

¹³¹ CONGRESSIONAL HANDBOOK, *supra* note 18, at 369. For an identification and discussion of federal laws that affect domestic minerals production, see *Nonfuel Minerals Policy Review, Part II*, *supra* note 43, at 444-49; and U.S. MINERALS VULNERABILITY REPORT, *supra* note 19, at 50-58. For a discussion on the impact of federal environmental laws on mining operations, see Friedman, *The Operational Impact of NEPA and Related Environmental Laws, Regulations, and Orders on Mineral Operations*, 19 ROCKY MTN. MIN. L. INST. 47 (1974).

¹³² 30 U.S.C. §§ 21-54 (1982 & Supp. III 1985).

¹³³ 42 U.S.C. §§ 4321-4369 (1982 & Supp. III 1985).

¹³⁴ 42 U.S.C. §§ 7401-7642 (1982 & Supp. III 1985).

¹³⁵ 33 U.S.C. §§ 1251-1376 (1982 & Supp. III 1985).

¹³⁶ 42 U.S.C. §§ 6901-6987 (1982 & Supp. III 1985).

¹³⁷ 29 U.S.C. §§ 651-678 (1982 & Supp. III 1985).

¹³⁸ 30 U.S.C. §§ 801-962 (1982 & Supp. III 1985).

¹³⁹ 30 U.S.C. §§ 1201-1328 (1982 & Supp. III 1985).

¹⁴⁰ 43 U.S.C. §§ 1701-1783 (1982 & Supp. III 1985).

¹⁴¹ CONGRESSIONAL HANDBOOK, *supra* note 18, at 369-70.

¹⁴² *Id.* at 370. See also AN ANALYSIS OF THE U.S. MINING INDUSTRY, *supra* note 82, at 23.

- (8) Have contributed to the shutting down of production capacity;
- (9) Have reduced access to federal lands containing potentially rich deposits of various minerals; and
- (10) Have become one of the most significant materials-related problems now facing the nation.¹⁴³

The financial cost of compliance with regulatory standards hampers domestic mineral exploration and development¹⁴⁴ and may reach fifteen percent of overhead costs.¹⁴⁵ The Department of Commerce concluded that it will cost the United States copper industry over \$1.4 billion (in 1974 dollars), from 1978 to 1987, to comply with federal pollution control standards and land use requirements.¹⁴⁶ Industry leaders' testimony before Congress indicates further that probably two and perhaps three of the United States' thirteen copper smelters have closed as a result of environmental regulations, reducing the United States' end product copper producing capacity by about twenty-five percent.¹⁴⁷ The relatively high compliance costs of

¹⁴³ CONGRESSIONAL HANDBOOK, *supra* note 18, at 370.

On the other hand, representatives of environmental groups point out that these laws provide benefits to the United States, including:

- [1.] Preserving the environmental integrity of the [n]ation's land, water, and air resources;
- [2.] Protecting the interests of consumers;
- [3.] Maintaining healthy [competition] in the market by preventing predatory monopolistic practices;
- [4.] Enhancing the decision-making process regarding future Federal actions affecting the environment; and
- [5.] Protecting worker health and safety.

Id. at 370-71.

¹⁴⁴ See AN ANALYSIS OF THE U.S. MINING INDUSTRY, *supra* note 82, at 26; U.S. MINERALS VULNERABILITY REPORT, *supra* note 19, at 56; NEED FOR NATIONAL MATERIALS POLICY & PLANNING, *supra* note 4, at 37-38.

¹⁴⁵ See *Nonfuel Minerals Policy Review, Part I*, *supra* note 18, at 150-51 (statement of Herman Enzer, United States Department of the Interior).

¹⁴⁶ U.S. MINERALS VULNERABILITY REPORT, *supra* note 19, at 56. In 1976, United States businesses spent \$35 billion for pollution control, and these expenditures were large enough to affect the national economy. NEED FOR NATIONAL MATERIALS POLICY & PLANNING, *supra* note 4, at 37.

¹⁴⁷ *Hearings on H.R. 2743*, *supra* note 110, at 79 (statement of Richard W. Banghart, Manager, Nevada Mines Division, Kennecott Minerals Co.).

An illustration of forced plant closures due to the cost of compliance with environmental regulations is the closure in 1979 of the Monaca, Pennsylvania, zinc smelter. That smelter produced about 25% of United States capacity in 1978 and was closed after the company expended \$35 million over the preceding five years to comply with the Environmental Protection Agency's (EPA) pollution standards. The company was not able to commit an additional \$25 million to comply with new lead standards promulgated by EPA and the Occupational Safety and Health Administration because of financial losses suffered during the previous two years. U.S. MINERALS VULNERABILITY REPORT, *supra* note 19, at 33.

federal regulatory standards may also precipitate relocation of mineral exploration and development projects to foreign areas.¹⁴⁸

On public land that is available for mineral exploration, obtaining the federal, state, and local government permits required to develop a mineral project can cause lengthy administrative delays and increase the cost of mineral projects.¹⁴⁹ Processing lease applications for exploration and development on federal lands requires coordination among the United States Geological Survey, the Bureau of Land Management of the Department of the Interior, and the United States Forest Service.¹⁵⁰ The minimum processing time for approval of a prospective lease is seventeen months and for a mineral lease and mining plant permit, three years.¹⁵¹ Contributing to cost and delay in domestic mineral production is the fact that government policy decisions regarding mineral production are often uncoordinated and contradictory, and may vary according to circumstances and the government agency involved.¹⁵²

¹⁴⁸ AN ANALYSIS OF THE U.S. MINING INDUSTRY, *supra* note 82, at 28-30; *see also* NEED FOR NATIONAL MATERIALS POLICY & PLANNING, *supra* note 4, at 24-25.

¹⁴⁹ AN ANALYSIS OF THE U.S. MINING INDUSTRY, *supra* note 82, at 23, 29. For illustration, in August 1976 a United States firm applied for two federal prospecting permits covering tracts in Idaho. It took 24 months of processing time for the permits to reach the Secretary of the Interior's Office for final signature. *Id.* at 23.

¹⁵⁰ *Id.*

¹⁵¹ *Id.* Final approval to develop a domestic mineral project is a time consuming process that usually necessitates [1] preparation and approval of environmental impact statements, and air, water quality, and solid waste disposal plans; [2] preparation of a Cultural Resource Survey Report by a state historical preservation officer; [3] negotiation of water rights; and [4] a variety of state and local clearances. *Id.* Other industrialized nations have similar environmental requirements, but the time required to obtain approval is shorter, and the increase to project costs are thereby minimized. For example, it takes two years to plan and construct a steel mill in Japan, a country with strict environmental standards, and costs about \$600 per annual ton of capacity. The time delay in obtaining administrative approval is a main reason for the difference in project costs. *Id.*

¹⁵² U.S. MINERALS VULNERABILITY REPORT, *supra* note 19, at 29-30.

Every other country in the world, particularly the Communist bloc countries, does everything in its power to support its minerals industry. Yet we seem to be destined to travel along a path of minerals self-destruction. Each Federal agency goes on its independent way, concerned only with its own particular mission. The Environmental Protection Agency oversees the industry by way of the Clean Air Act, the Water Pollution Control Act, the Safe Drinking Water Act, and the Solid Waste Disposal Act. The Occupational Safety and Health Administration imposes health and safety standards. The Department of the Treasury looks only to the integrity of the tax code. In addition, Interior apparently does not understand the importance of minerals in its land planning process. The national tragedy is that no element of the Federal Government is looking at the total question of how all the regulatory processes are having an adverse impact on this national interest.

Nonfuel Minerals Policy Review, Part I, *supra* note 18, at 3 (statement of Rep. James D. Santini, Nev., Chairman of the Subcommittee on Mines and Mining).

Environmental protection is a worthwhile national goal. The policy conflicts, however, among mineral production, environmental protection, and the United States' balance of trade are complex.¹⁵³ The trend toward environmental protection regardless of economic impact has led to burdensome regulations, imposes substantial costs, and threatens the continued operation of some domestic mining projects "which may not be able either to achieve compliance or to remain competitive with foreign producers that do not have to meet such standards."¹⁵⁴ Furthermore, observers dispute the mineral industry's financial and technical ability to comply with regulations, as well as the value of anticipated benefits from compliance.¹⁵⁵ Domestic mineral operations incur higher costs due to compliance with environmental and health and safety standards set by the federal government.¹⁵⁶ The minerals industry maintains that this investment in regulatory compliance could be better allocated to modernizing facilities so that the industry would be competitive in the world minerals trade.¹⁵⁷

D. Antitrust Enforcement

Capital intensive industries, such as mining, can benefit from the pooling of money, skills, property, equipment, and knowledge by two or more companies for a particular business project.¹⁵⁸ Such pooling of resources spreads costs and risks in developing the project.¹⁵⁹ The traditional hostility of United States antitrust policies toward joint ventures discourages domestic firms from initiating one of the most attractive financing alternatives available to them¹⁶⁰ because:

[1] U.S. antitrust laws are based on definitions of monopoly and competition that do not recognize the role of foreign competition in the domestic market.

¹⁵³ U.S. MINERALS VULNERABILITY REPORT, *supra* note 19, at 33.

¹⁵⁴ AN ANALYSIS OF THE U.S. MINING INDUSTRY, *supra* note 82, at 39; U.S. MINERALS VULNERABILITY REPORT, *supra* note 19, at 51. The relatively high costs of automobile emission control standards for the mineral industry in the United States has led to concern that the development of new mineral projects may shift to other countries. AN ANALYSIS OF THE U.S. MINING INDUSTRY, *supra* note 82, at 28.

¹⁵⁵ AN ANALYSIS OF THE U.S. MINING INDUSTRY, *supra* note 82, at 26, 39.

¹⁵⁶ *Id.* at 39. "The cost of labor, including wages, fringe benefits, and health and safety measures, can account for as much as one-third of total production costs in some [domestic] mineral projects." *Id.* at 38.

¹⁵⁷ *Hearings on H.R. 2743*, *supra* note 110, at 78 (statement of Richard W. Banghart, Manager, Nevada Mines Division, Kennecott Minerals Co.).

¹⁵⁸ AN ANALYSIS OF THE U.S. MINING INDUSTRY, *supra* note 82, at 34.

¹⁵⁹ *Id.*

¹⁶⁰ *Id.*; U.S. MINERALS VULNERABILITY REPORT, *supra* note 19, at 44.

[2] U.S. antitrust laws are nonspecific, and companies often spend considerable time evaluating proposed joint arrangements only to find that after initiation they are subject to Government surveillance and investigation.

[3] The extent of the applicability of U.S. antitrust laws to international activities of American multinational corporations is unclear and confusing.

[4] The Justice Department is antagonistic toward the Webb-Pomerene Act, a major antitrust exemption available to certain U.S. exporters.¹⁶¹

Federal antitrust law dates from the Sherman Act of 1890¹⁶² and the Clayton¹⁶³ and Federal Trade Commission Acts¹⁶⁴ of 1914. The United States antitrust laws are intended to support competition and protect the American consumer from collusive business practices.¹⁶⁵ These three laws were enacted in an era of powerful oil, railroad, and other "trusts,"¹⁶⁶ at a time when foreign producers held an insignificant percentage of domestic markets and definitions of monopoly and competition were based on domestic production.¹⁶⁷

Foreign competition in the world minerals market has increased, but the antitrust laws have not been updated to reflect the competition's impact on the domestic minerals industry.¹⁶⁸ Increasingly,

¹⁶¹ AN ANALYSIS OF THE U.S. MINING INDUSTRY, *supra* note 82, at 34. "The Webb-Pomerene Act [15 U.S.C. §§ 61-66 (1982)] is a special antitrust exemption which permits the formation of collective export associations of United States producers of 'goods, wares, or merchandise' so that they may compete more effectively in overseas [markets]" AN ANALYSIS OF THE U.S. MINING INDUSTRY, *supra* note 82, at 37. To qualify, the association must engage solely in export trade. 15 U.S.C. § 62 (1982). The Justice Department recommends the revocation of the Act because it does not require businesses to demonstrate that market conditions justify formation of an association, and to qualify companies need only to register with the Federal Trade Commission. AN ANALYSIS OF THE U.S. MINING INDUSTRY, *supra* note 82, at 37; see 15 U.S.C. § 65 (1982).

¹⁶² 15 U.S.C. §§ 1-7 (1982 & Supp. III 1985). The Sherman Act prohibits restraints of trade affecting United States domestic and international commerce. *Id.* § 1. The Act also prohibits domestic and international attempts to monopolize trade. *Id.* § 2.

¹⁶³ 15 U.S.C. §§ 12-27 (1982 & Supp. III 1985). The Clayton Act prohibits price discrimination, certain exclusive dealing arrangements, and outlaws mergers and acquisitions which would tend to create a monopoly or substantially lessen competition. *Id.* §§ 13-14.

¹⁶⁴ 15 U.S.C. §§ 41-51 (1982 & Supp. III 1985). The Federal Trade Commission Act has broad provisions prohibiting such practices as price fixing, boycotts, and anticompetitive mergers. *Id.* § 45.

¹⁶⁵ H.R. REP. NO. 49, 94th Cong., 2d Sess. 3-4 (1976), reprinted in 1976 U.S. CODE CONG. & ADMIN. NEWS, at 2572-73.

¹⁶⁶ See generally J. CISE, W. LIFLAND & L. SORKIN, UNDERSTANDING THE ANTITRUST LAWS 16-24 (9th ed. 1986); E. KINTNER, 1 FEDERAL ANTITRUST LAW: ECONOMIC THEORY, COMMON LAW, AND AN INTRODUCTION TO THE SHERMAN ACT 77-124 (1980).

¹⁶⁷ AN ANALYSIS OF THE U.S. MINING INDUSTRY, *supra* note 82, at 35.

¹⁶⁸ *Id.*; see also U.S. MINERALS VULNERABILITY REPORT, *supra* note 19, at 43. "[T]he view

world mineral markets are dominated by state-owned or state-controlled enterprises whose national policies dictate behavior that often does not conform to the competitive, private enterprise model upon which United States antitrust policy is based.¹⁶⁹ For example, unprofitable mineral production may be continued despite reduced consumer demand in order to produce foreign exchange earnings or to maintain employment levels as a means of preventing social unrest.¹⁷⁰ In contrast to the United States, the European Economic Community and Japan have liberalized their antitrust laws significantly to permit domestic companies to improve production and encourage small, inefficient firms to combine into larger, more efficient operations.¹⁷¹

United States antitrust laws are general in language and do not specifically identify legal and illegal practices. Actual policy directed at promoting competition and controlling monopolistic business activity has been established largely by judicial decisions and agency enforcement.¹⁷² Business firms considering a joint venture must invest considerable time and resources examining whether the partnership might violate United States antitrust laws.¹⁷³ The perceived threat of government investigation for antitrust violation has inhibited a number of firms from forming joint ventures¹⁷⁴ and has discouraged foreign firms from participating in joint ventures with United States businesses.¹⁷⁵

E. Capital Formation Problems

Three characteristics distinguish investment in the nonfuel minerals industry from investment in other industries: (1) large capital requirements; (2) long lengths of time before debt retirement; and

of the United States as a [single, predominant] market for purposes of antitrust analysis is largely obsolete." *Id.*

¹⁶⁹ *Id.* at 44.

¹⁷⁰ *Id.*

¹⁷¹ AN ANALYSIS OF THE U.S. MINING INDUSTRY, *supra* note 82, at 35; *see also* U.S. MINERALS VULNERABILITY REPORT, *supra* note 19, at 44.

¹⁷² AN ANALYSIS OF THE U.S. MINING INDUSTRY, *supra* note 82, at 35.

¹⁷³ *Id.*

¹⁷⁴ *Id.* at 36.

¹⁷⁵ AN ANALYSIS OF THE U.S. MINING INDUSTRY, *supra* note 82, at 36. One of the reasons why foreign firms hesitate to enter into joint ventures with American companies is that "at any point during the investigation of a joint undertaking involving U.S. firms, the records of all concerned parties, including foreign firms, can be subpoenaed, even when the operation is outside the United States." *Id.*

(3) the high risk nature of such investments.¹⁷⁶ "Mining is the most capital intensive of all industries."¹⁷⁷ A \$100 million project is common, and expenditures on a single project can exceed \$1 billion.¹⁷⁸ Capital is committed for considerable periods of time before revenue is generated from the project. Long lead times of as much as five to ten years are required for a new mine to be developed to full production.¹⁷⁹ Few companies have the means to finance such projects from cash generated through operations, and outside investors, usually commercial lending institutions, are required to provide the needed capital.¹⁸⁰ The federal government's restrictions to public land access and burdensome environmental standards on mining and mineral processing have hindered the ability to generate funds from these sources.¹⁸¹ Government actions have increased costs, impeded capital formation, and discouraged investment in mineral projects in the United States,¹⁸² and the lack of available capital has hindered domestic mining firms from expanding and modernizing mineral production.¹⁸³

F. Tax Policy Problems

Tax policy has an important influence on domestic mineral production, the profitability of mining properties, and the financial health of the domestic industry.¹⁸⁴ The federal income tax system does not encourage investment in the mining industry to the extent provided by most other countries.¹⁸⁵ Taxes in the United States on mineral producers are higher than those in most other industrialized

¹⁷⁶ CONGRESSIONAL HANDBOOK, *supra* note 18, at 374; *see also* AN ANALYSIS OF THE U.S. MINING INDUSTRY, *supra* note 82, at 16.

¹⁷⁷ U.S. MINERALS VULNERABILITY REPORT, *supra* note 19, at 38.

¹⁷⁸ AN ANALYSIS OF THE U.S. MINING INDUSTRY, *supra* note 82, at 16.

¹⁷⁹ *See* CONGRESSIONAL HANDBOOK, *supra* note 18, at 373-74.

¹⁸⁰ AN ANALYSIS OF THE U.S. MINING INDUSTRY, *supra* note 82, at 30.

¹⁸¹ *See id.* at 25; CONGRESSIONAL HANDBOOK, *supra* note 18, at 374.

¹⁸² *See* AN ANALYSIS OF THE U.S. MINING INDUSTRY, *supra* note 82, at 25; *see also* NEED FOR NATIONAL MATERIALS POLICY & PLANNING, *supra* note 4, at 25.

¹⁸³ AN ANALYSIS OF THE U.S. MINING INDUSTRY, *supra* note 82, at 16; CONGRESSIONAL HANDBOOK, *supra* note 18, at 375. "[R]esearch, development, and technological innovation, especially related to improved materials and new processing technologies, are important factors which affect [the Nation's] long-term capability for economic competitiveness, as well as for adjustment to interruptions in supply of critical minerals and materials." 30 U.S.C. § 1801(a)(4) (Supp. III 1985).

¹⁸⁴ AN ANALYSIS OF THE U.S. MINING INDUSTRY, *supra* note 82, at 45.

¹⁸⁵ *Id.*; *see also* U.S. MINERALS VULNERABILITY REPORT, *supra* note 19, at 41.

nations.¹⁸⁶ Under United States tax laws, capital recovery for reinvestment is much slower for American industry than for similar industries in most foreign countries.¹⁸⁷ Uncertainty about the future tax structure also detracts from desired investment. Changes and major reform in United States tax laws undermine the stability needed to make long-term planning and financial decisions.¹⁸⁸ Foreign governments allow firms to recover a higher percentage of capital outlays in the early years of new projects which in turn provides funds for earlier capital investment.¹⁸⁹ The early recovery of capital expenditures is particularly important during periods of high inflation, such as the nation experienced during the 1970s, because it minimizes the effects of inflation on depreciation allowances.¹⁹⁰

Federal tax laws, therefore, are among the obstacles confronting the United States' domestic mining industry since they do not recognize the capital formation needs and cost of operations placed on the industry. The federal government must provide greater incentive for investment in the mining industry and alleviate the burden imposed on the industry by stabilizing tax laws and allowing faster recovery of capital expenditures.¹⁹¹

G. The Effect of Government Policy on the Domestic Minerals Industry

During the 1970s, the domestic minerals industry experienced a severe and prolonged downturn leading to concern about its financial health. Contributing factors included the cost of implementing environmental programs, the increase in debt for many firms that

¹⁸⁶ GENERAL ACCOUNTING OFFICE, REPORT TO THE CONGRESS, ASSESSING THE IMPACT OF FEDERAL AND STATE TAXES ON THE DOMESTIC MINERALS INDUSTRY 1 (June 8, 1981) [hereinafter *IMPACT OF TAXES ON THE MINERALS INDUSTRY*].

¹⁸⁷ AN ANALYSIS OF THE U.S. MINING INDUSTRY, *supra* note 82, at 46; CONGRESSIONAL HANDBOOK, *supra* note 18, at 375.

¹⁸⁸ AN ANALYSIS OF THE U.S. MINING INDUSTRY, *supra* note 82, at 48.

¹⁸⁹ *Id.* at 48-49.

¹⁹⁰ *Id.* at 49.

¹⁹¹ U.S. MINERALS VULNERABILITY REPORT, *supra* note 19, at 42. There are three important provisions of the federal tax code which support the domestic minerals industry: the depletion allowance, the investment tax credit, and the expensing privileges for exploration and development expenditures. *IMPACT OF TAXES ON THE MINERALS INDUSTRY*, *supra* note 186 at 5. The depletion allowance provides a tax deduction for the depletion of natural resources. *Id.* at 5. The investment tax credit provides a credit against federal tax liability for a percent of the cost of acquiring such depreciable assets as equipment and machinery. *Id.* at 40. Federal tax laws provide tax deductions for costs associated with mine exploration and development. *Id.* at 49.

previously had relied primarily on equity financing, and competition from foreign producers. Government subsidies and the strong dollar aid foreign mineral producers, making their low cost products attractive to United States customers and depressing world mineral prices.¹⁹² The depression in the mining industry is the latest example of an industrial megatrend—the shift of the production and processing of basic materials, including steel, from the United States to the developing nations of the Third World.¹⁹³ Lower prices benefit manufacturers and consumers, but some observers are concerned that the mining industry's problems may risk national security. Representative Morris K. Udall, chairman of the House Committee on Interior and Insular Affairs, asserts that the United States "need[s] a copper industry, for defense purposes if nothing else."¹⁹⁴

Although the natural distribution and quality of mineral deposits are major factors in mineral availability, in the United States, government policies have also limited domestic exploration and development.¹⁹⁵ In contrast to United States' restrictions on mineral operations, foreign governments often provide substantial incentives and subsidies to their mineral industries to encourage development

¹⁹² *The Death of Mining*, *supra* note 33, at 65; see also Houston, *Can Anything Shake the Depression in Metals?*, BUS. WK., Mar. 22, 1985, at 245. For a discussion on the demise of the mining industry, see Note, *supra* note 94; AN ANALYSIS OF THE U.S. MINING INDUSTRY, *supra* note 82.

¹⁹³ *The Death of Mining*, *supra* note 33, at 64–65. "[T]he Nation's industrial base, including the capacity to process minerals and materials, is deteriorating—both in terms of facilities and in terms of a trained labor force." 30 U.S.C. § 1801(a)(3) (Supp. III 1985). The economic condition of the mining industry has deteriorated to the point that the United States is in danger of losing 75% of its copper industry, 40% to 50% of its iron-ore industry, and 90% of its potash industry. *Hearings on Nat'l Critical Materials Act*, *supra* note 3, at 57 (statement of T.S. Ary, President, Minerals Exploration Division, Kerr-McGee Corp. and Chairman, Minerals Availability Committee, American Mining Congress).

The shift of the production and processing of basic materials from the United States to the developing nations is primarily due to cheap labor, government support of mineral operations, and very low cost reserves. *The Death of Mining*, *supra* note 33, at 64–65, 67. For example, Chilean copper workers earn only one tenth of what United States copper companies pay their workers. *Id.* at 67. The Chilean government of military strongman, Augusto Pinochet, has monumental problems, and internal pressure keeps copper production and exports high despite reduced demand and depressed prices for the metal. *Id.* at 65, 67. Accelerated copper production provides employment in a country where 25% of the work force is idle, and generates foreign exchange to maintain Chile's international debt payments without imposing unpopular austerity measures. *Id.* at 67. Furthermore, many of the richest mineral deposits in the United States are close to depletion and the remaining ore grade is frequently too costly to mine with current prices. *Id.* at 65.

¹⁹⁴ *Id.* at 65; Santini, *The Growing Crisis in the Strategic and Critical Minerals of the United States*, 7 J. LEGIS. 63 (1980).

¹⁹⁵ AN ANALYSIS OF THE U.S. MINING INDUSTRY, *supra* note 82, at 18.

within their countries.¹⁹⁶ Government actions have not only hindered domestic mineral development but in some cases have actually assisted foreign competition. For example, the federal government supported the World Bank's International Finance Corporation's decision to provide \$1 billion to modernize and expand the Cananea copper project in Mexico, located thirty miles south of the United States.¹⁹⁷ This assistance was provided despite the severe depression in the copper industry¹⁹⁸ and "the possible harm this extension . . . might cause [to] United States copper producers."¹⁹⁹

Given the traditional hostility of many federal policies toward the mining and minerals processing industries,²⁰⁰ it is not surprising that the minerals industry tends to view the federal government as an adversary.²⁰¹ A representative of Anaconda Copper Company stated in a congressional hearing: "Having been in this industry for a long time, I am convinced most of our problems are created by the Government and in no way can the Government be absolved."²⁰² Government representatives tend to concur that the Department of the Interior, which oversees all aspects of federal land management, has adopted policies that have proved to be counterproductive to mineral development.²⁰³ One government report stated that "the orientation of the Department of the Interior . . . has been one of fundamental skepticism if not outright opposition to mineral explo-

¹⁹⁶ *Id.* at 23-24, 32-33; see also NEED FOR NATIONAL MATERIALS POLICY & PLANNING, *supra* note 4, at 26-27. "[W]hile other nations have developed and implemented specific long-term research and technology programs to develop high-performance materials, no such policy and program evolution has occurred in the United States." 30 U.S.C. § 1801(a)(5) (Supp. III 1985).

¹⁹⁷ *Geopolitics of Strategic and Critical Materials: Hearings on the Geopolitics of Strategic and Critical Materials Before the Senate Comm. on Energy and Natural Resources*, 98th Cong., 1st Sess. 7 (1983) [hereinafter *Hearings on Geopolitics of Strategic and Critical Materials*] (statement of Sen. James A. McClure, Idaho).

¹⁹⁸ *Id.* The Federal Government justified assisting in the expansion of Cananea's copper production facilities as a program in the Nation's interest. According to the State Department, "Mexico's continued economic development is very important to its political stability," and a viable Mexican export trade is required to service its debt to United States banks. *Id.* at 36.

¹⁹⁹ *Id.*

²⁰⁰ U.S. MINERALS VULNERABILITY REPORT, *supra* note 19, at 27, 44.

²⁰¹ CONGRESSIONAL HANDBOOK, *supra* note 18, at 378-79.

²⁰² *Hearings on H.R. 2743*, *supra* note 110, at 83 (statement of Howard L. Edwards, General Attorney, Anaconda Copper Co.).

²⁰³ There have been proposals to designate the Bureau of Land Management (BLM) as the nation's advocate for minerals development. *Interior May Turn BLM into 'Minerals Advocate'*, Washington Post, Jan. 21, 1987, at 20, col. 1. Such single-use designation, however, may conflict with FLPMA's requirements that the BLM manage public lands according to multiple use. 43 U.S.C. § 1701(a)(7) (1982).

ration and development."²⁰⁴ Western states, objecting to the large percentage of their land owned by the federal government, are also dissatisfied with federal land management policies.²⁰⁵ The adversarial relationship between the federal government and the minerals industry has been characterized "as the nation's most serious deficiency regarding materials policy and . . . represent[s] one of the major causes of materials supply and other economic problems."²⁰⁶

IV. PAST COMMISSION AND LEGISLATIVE ACTIVITY ON MINERALS POLICY

A. Major Commissions on National Materials Policy

Although concern about the United States' vulnerability to mineral supply disruptions has only recently received widespread national attention, it has been an issue debated in and out of government for decades.²⁰⁷ President Theodore Roosevelt's National Conservation Commission, the first national commission to examine the use of the nation's natural resources, predicted in 1909 that domestic resources of petroleum and high grade iron ore would be depleted by mid-century.²⁰⁸ During the period 1951–1976, four major study commissions on minerals policy were created by the federal government, two by the White House and two by Congress.²⁰⁹

The two Presidential Commissions were created in response to materials shortages during wartime.²¹⁰ The President's Materials Policy Commission was created in 1951 due to President Truman's concern over the materials supply shortages experienced during World War II and the Korean War.²¹¹ Known as the Paley Commission in honor of its chairman, William S. Paley, it developed a massive and comprehensive analysis of the long range aspects of the

²⁰⁴ U.S. MINERALS VULNERABILITY REPORT, *supra* note 19, at 59.

²⁰⁵ See Titus, *The Nevada "Sagebrush Rebellion" Act: A Question of Constitutionality*, 23 ARIZ. L. REV. 263 (1981); Mollison & Eddy, *The Sagebrush Rebellion: A Simplistic Response to the Complex Problems of Federal Land Management*, 19 HARV. J. ON LEGIS. 97 (1982); Leshy, *Unraveling the Sagebrush Rebellion: Law, Politics and Federal Lands*, 14 U.C. DAVIS L. REV. 317 (1980); Comment, *The Sagebrush Rebellion: Who Should Control the Public Lands?*, 1980 UTAH L. REV. 505.

²⁰⁶ CONGRESSIONAL HANDBOOK, *supra* note 18, at 378–79.

²⁰⁷ *Id.* at 32.

²⁰⁸ U.S. MINERALS VULNERABILITY REPORT, *supra* note 19, at 8.

²⁰⁹ *Id.* at 8–13; see also CONGRESSIONAL HANDBOOK, *supra* note 18, at 32–39.

²¹⁰ U.S. MINERALS VULNERABILITY REPORT, *supra* note 19, at 8–10.

²¹¹ *Id.* at 8; see also CONGRESSIONAL HANDBOOK, *supra* note 18, at 32–33.

nation's materials supply problems.²¹² In its five-volume report to the President, entitled *Resources for Freedom*,²¹³ the Commission recognized that no nation can be totally self-sufficient in minerals.²¹⁴ It specifically rejected the materials self-sufficiency argument, even for national security reasons, arguing instead in favor of the "least cost principle."²¹⁵ According to this principle, national minerals policy should be based on buying at the least cost possible,²¹⁶ and "foreign imports provide least-cost benefits to the consumer."²¹⁷

The 1954 Report of the President's Cabinet Committee on Minerals Policy, known as the Eisenhower Report, emphasized the government's role in strengthening domestic mineral production and building mineral stockpiles to improve the nation's national security.²¹⁸ Like the Paley Report, the Eisenhower Report called attention to the United States' growing minerals import dependency²¹⁹ and how the country had completed a "slow transition from a raw materials *surplus* nation to a raw materials *deficit* nation."²²⁰

In 1970, Congress established the National Commission on Materials Policy under Title II of the Resource Recovery Act.²²¹ The purpose of the Commission was "to enhance environmental quality and conserve materials by developing a national materials policy to utilize present resources and technology more efficiently, to anticipate the future materials requirements of the nation and the world, and to make recommendations on the supply, use, recovery, and disposal of materials."²²² Like the Paley and Eisenhower Commissions, the National Commission on Materials Policy recognized the role of foreign supplies in meeting domestic mineral requirements,²²³ and concluded that "in the interest of national security, it is unwise

²¹² CONGRESSIONAL HANDBOOK, *supra* note 18, at 33; *see also* U.S. MINERALS VULNERABILITY REPORT, *supra* note 19, at 8-9.

²¹³ CONGRESSIONAL HANDBOOK, *supra* note 18, at 33. "The five volumes of the study were titled individually, as follows: I, Foundations for Growth and Security; II, The Outlook for Key Commodities; III, The Outlook for Energy Sources; IV, The Promise of Technology; and V, Selected Reports to the Commission." *Id.*

²¹⁴ *Id.* at 35.

²¹⁵ *Id.*

²¹⁶ *Id.*

²¹⁷ U.S. MINERALS VULNERABILITY REPORT, *supra* note 19, at 12.

²¹⁸ *Id.* at 9-10.

²¹⁹ *Id.*

²²⁰ CONGRESSIONAL HANDBOOK, *supra* note 18, at 34 (quoting final report of the Paley Commission entitled *Resources for Freedom*).

²²¹ Pub. L. No. 91-512, § 202, 84 Stat. 1227 (1970); *see also* CONGRESSIONAL HANDBOOK, *supra* note 18, at 35.

²²² Pub. L. No. 91-512, § 202, 84 Stat. 1227 (1970). *See also id.* § 204, 84 Stat. 1229.

²²³ U.S. MINERALS VULNERABILITY REPORT, *supra* note 19, at 11.

to become dependent upon specific strategic commodities for which the United States lacks a resource base and which are obtained mainly from a small number of countries which may choose to restrict or cut off the flow of supply."²²⁴

The National Commission on Supplies and Shortages was established in 1974 by an act of Congress which bore that name.²²⁵ The Commission was established after the 1973-1974 oil embargo and during a period of widespread shortages of resources and commodities.²²⁶ The Act, for the first time, provided a legislative statement about commodity shortages, United States dependency upon foreign sources of minerals supply, and vulnerability to supply interruption.²²⁷ The Commission was to identify and evaluate shortages in materials, resources, or commodities,²²⁸ and report on existing governmental policies affecting supply²²⁹ and economic stockpiling²³⁰ of natural resources. The Commission was also to develop an information system for examining and predicting shortages and to determine what institutional adjustments were needed to analyze the economic needs for resources on a permanent basis.²³¹ The Commission's report concluded that the most likely threat to supply interruption in the next quarter century was not from foreign embargoes or cartel formation but from military conflict, regional war, or civil disorder.²³² Comprehensive strategic and economic stockpiling of essential resources was the solution proposed.²³³

²²⁴ CONGRESSIONAL HANDBOOK, *supra* note 18, at 36 (quoting NAT'L COMM'N ON MATERIALS POLICY, MATERIAL NEEDS AND THE ENVIRONMENT TODAY AND TOMMORROW (1980)).

²²⁵ 50 U.S.C. app. § 2169(d) (1982).

²²⁶ CONGRESSIONAL HANDBOOK, *supra* note 18, at 37. *See also* U.S. MINERALS VULNERABILITY REPORT, *supra* note 19, at 11; 50 U.S.C. app. § 2169(b)(3) (1982).

²²⁷ U.S. MINERALS VULNERABILITY REPORT, *supra* note 19, at 11. In the Act Congress finds that:

(1) The United States is increasingly dependent on the importation from foreign nations of certain natural resources vital to commerce and the national defense.

(2) Nations that export such resources can alone or in association with other nations arbitrarily raise the prices of such resources to levels which are unreasonable and disruptive of domestic and foreign economies.

(3) Shortages of resources and commodities are becoming increasingly frequent in the United States, and such shortages cause undue inconvenience and expense to consumers and a burden on interstate commerce and the Nation's economy.

50 U.S.C. app. § 2169(b)(1)-(3) (1982).

²²⁸ *Id.* § 2169(c), (g)(1)-(3).

²²⁹ *Id.* § 2169(g)(4).

²³⁰ *Id.* § 2169(g)(5).

²³¹ *Id.* § 2169(c), (g)(6).

²³² CONGRESSIONAL HANDBOOK, *supra* note 18, at 38. *See also* U.S. MINERALS VULNERABILITY REPORT, *supra* note 19, at 11-12.

²³³ *See* CONGRESSIONAL HANDBOOK, *supra* note 18, at 38-39. *See also* 50 U.S.C. app. § 2169(g)(5) (1982).

Several conclusions can be drawn from the studies prepared by these commissions. All of the commissions recognized the importance of adequate mineral supplies and a strong domestic mining and minerals processing industry.²³⁴ All support the "least cost principle" that foreign imports, because of their cheap cost, provide the greatest benefits to the consumer.²³⁵ At the same time, the commissions warned about the foreign policy implications of the United States' dependency on mineral imports.²³⁶ These commissions recommended that the government should improve its analytical capability and means of integrating information so that a comprehensive system could be developed to analyze the impacts of government policies upon the industry and larger national interest.²³⁷ The commission reports have had no significant impact on government policy formulation, both executive and legislative, "which, out of concern for the attainment of other national goals has given little or no priority to the Nation's minerals."²³⁸

B. Past Legislative Activity on Minerals Policy

Despite federal policy restricting mining access to public lands and regulating the minerals industries, Congress has recognized the importance of minerals to the nation and passed legislation to support domestic mining projects.²³⁹

1. The Mining and Minerals Policy Act of 1970

Congress has long understood that developing and maintaining a domestic mining and minerals industry is essential to national se-

²³⁴ U.S. MINERALS VULNERABILITY REPORT, *supra* note 19, at 12.

²³⁵ *Id.*

²³⁶ *Id.*

²³⁷ *Id.* See also GENERAL ACCOUNTING OFFICE, REPORT TO CONGRESS, INTERIOR PROGRAMS FOR ASSESSING MINERAL RESOURCES ON FEDERAL LANDS NEED IMPROVEMENTS AND ACCELERATION (1978); NEED FOR NATIONAL MATERIALS POLICY & PLANNING, *supra* note 4, at 12-21. In the National Commission on Supplies and Shortages Act of 1974 the Congress finds that:

[1.] Existing institutions do not adequately identify and anticipate such shortages and do not adequately monitor, study, and analyze other market adversities involving specific industries and specific sectors of the economy.

[2.] Data with respect to such shortages and adversities is collected in various agencies of the Government for various purposes, but is not systematically coordinated and disseminated to the appropriate agencies and to the Congress.

50 U.S.C. app. § 2169(b)(4)-(5) (1982).

²³⁸ U.S. MINERALS VULNERABILITY REPORT, *supra* note 19, at 13; see also NEED FOR NATIONAL MATERIALS POLICY & PLANNING PROCESS, *supra* note 4, at 4-8.

²³⁹ See CONGRESSIONAL HANDBOOK, *supra* note 18, at 57-74.

curity and the United States' economy.²⁴⁰ Until 1970, however, legislative and executive programs were individually directed toward an aspect of minerals problems, without a unified national mining and minerals policy.²⁴¹ In that year, Congress passed the Mining and Minerals Policy Act.²⁴² The Act established a broad overall national minerals policy,²⁴³ and is considered a landmark in the evolution of minerals legislation.²⁴⁴ The Mining and Minerals Policy Act established, as a continuing national policy, the goal of fostering and encouraging private enterprise in: (1) the development of an economically sound and stable domestic mining and minerals industry; (2) the orderly and economic development of domestic mineral resources; (3) mining research; and (4) the development of methods to dispose of mineral waste and the reclamation of mined land.²⁴⁵

The Act neither provided any new authority or funding nor called for establishing any organizational mechanism for achieving its objectives.²⁴⁶ Although the Act established policy for the entire federal government, it specifically directed the Secretary of the Interior to carry out the policy under existing authority and programs, and to make an annual report to the Congress showing the state of domestic mining and minerals industries, trends in use and depletion of these resources, and recommending legislative programs.²⁴⁷

Congress did not expect that the Mining and Minerals Policy Act, in and of itself, would be a cure-all for the minerals industry but did expect the legislation to focus attention on the industry and the need for long-range planning.²⁴⁸ The Act, therefore, is simply a statement of fundamental principles and objectives concerning a national minerals policy. Congress did not declare that the minerals industry's needs were superior to other national policies. Nevertheless, Congress clearly intended that the impacts of other national policies on the mining industry be evaluated completely when major federal actions are proposed.²⁴⁹

²⁴⁰ AN ANALYSIS OF THE U.S. MINING INDUSTRY, *supra* note 82, at 68.

²⁴¹ *Id.*; see also U.S. MINERALS VULNERABILITY REPORT, *supra* note 19, at 13-14.

²⁴² 30 U.S.C. § 21a (1982).

²⁴³ H.R. REP. NO. 1442, *supra* note 33, reprinted in 1970 U.S. CODE CONG. & ADMIN. NEWS 5792.

²⁴⁴ CONGRESSIONAL HANDBOOK, *supra* note 18, at 67.

²⁴⁵ 30 U.S.C. § 21a (1982).

²⁴⁶ AN ANALYSIS OF THE U.S. MINING INDUSTRY, *supra* note 82, at 68; H.R. REP. NO. 1442, *supra* note 33, reprinted in 1970 U.S. CODE CONG. & ADMIN. NEWS 5795.

²⁴⁷ 30 U.S.C. § 21a (1982).

²⁴⁸ H.R. REP. NO. 1442, *supra* note 33, reprinted in 1970 U.S. CODE CONG. & ADMIN. NEWS 5792, 5793.

²⁴⁹ AN ANALYSIS OF THE U.S. MINING INDUSTRY, *supra* note 82, at 68; U.S. MINERALS VULNERABILITY REPORT, *supra* note 19, at 14.

Congressional expectations in passing the Mining and Minerals Policy Act have not been fulfilled.²⁵⁰ The Department of the Interior has been criticized severely for not responding adequately to the Congressional directive under the Act.²⁵¹ During the 1970s, the Interior Department did little substantive work to implement a national materials policy in accordance with the Act.²⁵² The Secretary's annual reports "have degenerated to the point of being nearly useless."²⁵³ Effective implementation of the Act is also hindered by the lack of comprehensive guidelines to identify and balance conflicts among national policies, programs, and regulations.²⁵⁴

2. The National Materials and Minerals Policy, Research and Development Act of 1980

Congress' intent in passing the National Materials and Minerals Policy, Research and Development Act of 1980²⁵⁵ was to replace the existing *ad hoc* decisionmaking process with a mechanism to coordinate and implement a coherent national minerals and materials policy and program. By doing so, Congress intended to assure the availability of materials critical to the United States' economic well-being, national defense, and industrial production.²⁵⁶ Congress stated that notwithstanding the Mining and Minerals Policy Act of 1970, the United States did not have a coherent national minerals policy.²⁵⁷ The 1980 Act called for materials and minerals policymaking and analysis to be coordinated through the Executive Office of the President and Cabinet.²⁵⁸ The 1980 Act directs the President to coordi-

²⁵⁰ AN ANALYSIS OF THE U.S. MINING INDUSTRY, *supra* note 82, at 69.

²⁵¹ CONGRESSIONAL HANDBOOK, *supra* note 18, at 68; U.S. MINERALS VULNERABILITY REPORT, *supra* note 19, at 16-22.

²⁵² CONGRESSIONAL HANDBOOK, *supra* note 18, at 68. A government report stated that during the 1970s the Department of the Interior ignored the statutory language and fundamental purpose of the Act by abdicating "its assigned role and responsibility" for implementing the Mining and Mineral Policy Act of 1970. U.S. MINERALS VULNERABILITY REPORT, *supra* note 19, at 16, 22.

²⁵³ U.S. MINERALS VULNERABILITY REPORT, *supra* note 19, at 18.

Perhaps no single action by the Department of the Interior illustrates its abdication of the Mining and Minerals Policy Act of 1970 as do the annual reports issued under that statutory mandate. [T]he . . . reports [have] degenerated into a perfunctory and totally unsatisfactory fulfillment of the form but not the substance of the requirements of the Act.

Id. at 19-20.

²⁵⁴ AN ANALYSIS OF THE U.S. MINING INDUSTRY, *supra* note 82, at 69-70.

²⁵⁵ 30 U.S.C. §§ 1601-1605 (1982).

²⁵⁶ *Id.* § 1602. See also *id.* § 1601(a)(6).

²⁵⁷ *Id.* § 1601(a)(7).

²⁵⁸ *Id.* §§ 1602-1603.

nate responsible federal departments and agencies in fully implementing the Act's policies.²⁵⁹ The Act also directs the President to assume certain specific responsibilities, including assessing federal policies at all stages of the materials production cycle.²⁶⁰ It also assigns several federal departments and agencies specific responsibilities.²⁶¹

²⁵⁹ *Id.* § 1602. The Act declares it to be the policy of the United States to promote an adequate and stable supply of essential materials, necessary to maintain national security, economic well-being, and industrial production. The statement of policy requires that appropriate attention be given to achieving a long-term balance between energy needs, a healthy environment, natural resources conservation, and social needs. The declaration of policy also requires the President to ensure that six actions are taken. First, the President is to insure that the Federal Government identifies strategic materials needs and pursues measures that would assure the availability of materials critical to commerce and the economy. Second, the President shall establish administrative mechanisms for the coordination of federal materials programs, including research and development. Third, a capability is to be established to provide long-range assessments concerning materials demand, supply and needs and to provide the policies and programs necessary to meet those needs. Fourth, a vigorous and comprehensive program of materials research and development is to be carried out. Fifth, cooperative research and development programs are to be undertaken with other nations for the equitable and frugal use of materials and energy. Sixth, the President shall promote and encourage private enterprise and the development of economically sound and stable domestic materials industries. Finally, the President is directed to encourage federal agencies to facilitate availability and development of domestic resources to meet critical materials needs. *Id.*

²⁶⁰ *Id.* § 1603(8). The President shall pursue nine activities to implement the policies of the Act. First, the President is to assure that federal departments identify and make recommendations for carrying out policies that ensure an adequate materials supply. Second, the President shall support basic and applied research and development for the exploration, discovery, and recovery of nonfuel minerals, including recycling, conservation, substitution, and new engineering designs. Third, improved methods of collection and dissemination of materials information is to be carried out with federal, state and local governments, private industry, and universities. Fourth, an assessment of the need for technically trained personnel necessary for materials research, development, and industrial practice is to be undertaken. Fifth, an early warning system for materials supply problems is to be established. Sixth, the President shall recommend to the Congress appropriate measures to promote industrial innovation in materials technologies. Seventh, cooperative materials research and problem-solving is to be undertaken by private corporations and federal and state institutions having shared interests or objectives. Eighth, federal policies shall be assessed which affect all stages of the minerals production cycle, including tax policies. Finally, the President is directed to assess the opportunities for the United States to promote cooperative agreements for mineral development in foreign nations. *Id.* § 1603.

²⁶¹ *Id.* § 1604(b)-(f). The Director of the Office of Science and Technology Policy shall coordinate federal minerals research activities, and prepare an assessment of national materials needs. *Id.* § 1604(b). The Department of Commerce shall submit reports to Congress assessing critical materials needs of the United States and recommendations to meet such needs. *Id.* § 1604(c). The Secretary of Defense shall prepare and periodically revise reports assessing essential materials needs related to national security, and identify steps to meet those needs. *Id.* § 1604(d). The Secretary of the Interior must initiate actions to improve the Bureau of Mines' capacity to assess international mineral supplies and increase the level of mineral research by the Bureau of Mines. *Id.* § 1604(e). The Secretary must also improve the

The central purpose of the National Materials and Minerals Policy, Research and Development Act of 1980 was to establish a mechanism within the Office of the President that could lead to a sound national nonfuel minerals and materials policy.²⁶² The President's program formally assigned policy coordination responsibility to the Cabinet Council on National Resources and the Environment.²⁶³ "The Council is to ensure high-level consideration of important minerals and materials issues on a timely basis with the capability of prompt action on such issues by the President."²⁶⁴

The Council has not, however, provided the continuous decision and policy coordination required by the Act.²⁶⁵ Instead, the numerous federal departments, agencies, councils, committees, and task forces which have been delegated authority for discharging minerals policies, have proceeded independently.²⁶⁶ The programs and reports that they implement may exacerbate rather than mitigate the problems associated with the ad hoc coordination that the Act intended to replace by multiplying the number of activities that must be coordinated.²⁶⁷ Important actions affecting minerals policy have occurred without the Cabinet Council providing high-level consideration of these actions as required by the Act.²⁶⁸ Furthermore, the

availability and analysis of minerals information in federal land use decisionmaking. *Id.* § 1604(e)(3), (f).

Within one year of the date of enactment, or on October 21, 1980, the President was to submit to Congress a program plan setting forth, *inter alia*, the institutional changes with the Executive Office of the President necessary to implement the Act's policy to promote an adequate and stable supply of minerals and materials necessary to maintain national security, economic well-being, and industrial production. *Id.* § 1604(a).

²⁶² *Id.* §§ 1602-1603. Congress was hopeful that "elevating the leadership role to the Executive Office of the President should assure that departments and agencies will be permitted to exercise their responsibilities with an oversight of decision and policy coordination provided by the President." S. REP. NO. 937, 96th Cong., 2d Sess. 6, reprinted in 1980 U.S. CODE CONG. & ADMIN. NEWS 4886, 4888.

²⁶³ IMPLEMENTATION OF THE NATIONAL MINERALS AND MATERIALS POLICY, *supra* note 22, at 14.

²⁶⁴ *Id.*

²⁶⁵ *Id.* at 14-15.

²⁶⁶ *Id.* at 15.

²⁶⁷ *Id.*

²⁶⁸ *Id.* Cabinet Council coordination was not sought by the Department of Defense prior to requesting funds in 1982 to subsidize domestic mineral production as authorized by the Defense Production Act of 1950, 50 U.S.C. app. §§ 2061-2168 (1982 & Supp. III 1985). IMPLEMENTATION OF THE NATIONAL MINERALS AND MATERIALS POLICY, *supra* note 22, at 9. The Defense Production Act authorizes loans, loan guarantees, purchases, commitments to purchase, and floor price guarantees to establish or expand domestic minerals production capacity and supply. 50 U.S.C. app. §§ 2091-2093 (1982 & Supp. III 1985). Another important materials policy issue where the Cabinet Council was not involved was in the preparation of the President's fiscal year 1983 budget involving funding for the National Defense Stockpile in strategic minerals. IMPLEMENTATION OF THE NATIONAL MINERALS AND MATERIALS, *supra*

Cabinet Council lacks the breadth of membership required to formulate national minerals policy.²⁶⁹ "As a result, national minerals and materials policy and program planning continues to be primarily ad hoc and unstructured."²⁷⁰

3. The National Critical Materials Act of 1984

The Cabinet Council on Natural Resources and Environment has handled national materials policy inadequately, and consequently hindered the implementation of the National Materials and Minerals Policy, Research and Development Act of 1980. Of four reports and assessments required by the 1980 Act, only one had been presented officially to Congress as of October 1983.²⁷¹ The Cabinet Council is potentially useful as a mechanism to coordinate and implement a national materials policy.²⁷² Of great concern, however, is a future administration with different executive priorities or organizational ideas abolishing the Cabinet Council and returning materials policy to the inactive status of the past.²⁷³

4. Minerals Legislation to Support National Security and Defense

Congress has stressed through legislation the importance of safeguarding the vital nexus between strategic minerals sources and

note 22, at 10-11. The Strategic and Critical Materials Stock Piling Act, 50 U.S.C. §§ 98-100a (1982 & Supp. III 1985), provides that a stockpile of strategic and critical materials is to be maintained to prevent a dangerous and costly dependence on foreign supply sources during national emergencies. 50 U.S.C. app. §§ 98b-98e. A third materials policy issue in which the Cabinet Council did not participate was the implementation of the President's program plan to concentrate federally financed research and development on "long-term, high-risk, high potential payoff projects with the best chance of wide . . . application to materials problems and increased productivity." IMPLEMENTATION OF THE NATIONAL MINERALS AND MATERIALS POLICY, *supra* note 22, at 11-12. Finally, the Cabinet Council was not involved in the 1982 decision to provide federal support for a \$1 billion expansion of a Mexican Copper mining and smelting operation that occurred when the United States copper industry was experiencing a sharp decline in demand, prices, and profitability. *Id.* at 12-13.

²⁶⁹ *Id.* at 15. Membership in the Cabinet Council on Natural Resources includes the Secretary of the Interior as Chairman pro tem, the Attorney General and the Secretaries of Agriculture, Commerce, Transportation, Housing and Urban Development, and Energy. The Vice President, Counselor to the President, and the White House Chief of Staff serve as ex officio members. *Id.* at i. Absent from the Council's membership are sub-cabinet agencies with important minerals responsibilities and programs, such as the Federal Emergency Management Agency responsible for stockpile policy, and the Environmental Protection Agency responsible for environmental regulations affecting the mining industry. *Id.* at 14.

²⁷⁰ *Id.* at 15.

²⁷¹ H.R. REP. NO. 593 Part I, 98th Cong., 2d Sess. 18, reprinted in 1984 U.S. CODE CONG. & ADMIN. NEWS, 2230, 2233 [hereinafter H.R. REP. NO. 593].

²⁷² *Id.*

²⁷³ H.R. REP. NO. 593, *supra* note 271, at 18, reprinted in 1984 U.S. CODE CONG. & ADMIN. NEWS, at 2233.

national security. The Defense Production Act of 1950²⁷⁴ is the only statutory mechanism "for insuring that the nation's industrial base is kept in a state of readiness in peacetime so that new programs may be initiated and standby programs may be expanded in the event of mobilization."²⁷⁵ Title III of the Act authorizes the President to guarantee loans and to take other financial measures necessary to expand productive capacity and supply in the interest of national defense.²⁷⁶ Title III also authorizes the guaranteed long-term purchases of minerals and materials for government use, and for installing equipment and facilities in government or privately owned plants.²⁷⁷

The Domestic Minerals Program Extension Act of 1953²⁷⁸ reinforced the Defense Production Act of 1950 by extending its programs.²⁷⁹ The Act required federal agencies to take steps to decrease United States dependency on foreign sources of mineral supplies. The Act also

recognized that the continued dependence on overseas sources of supply for strategic or critical minerals and metals during periods of threatening world conflict or of political instability within those nations controlling the sources of supply of such materials gravely endangers the present and future economy and security of the United States.²⁸⁰

The Strategic and Critical Materials Stock Piling Revision Act of 1979²⁸¹ provides for the acquisition and retention of stocks of certain strategic and critical materials in order to preclude a dangerous and costly dependence by the United States upon foreign sources in times of national emergency.²⁸² The strategic and critical materials stockpile program is badly outdated.²⁸³ It has been nearly thirty years since major additions to the stockpiles were last made.²⁸⁴ Filling the stockpile to its authorized level would require the purchase of ad-

²⁷⁴ 50 U.S.C. app. §§ 2061-2168 (1982 & Supp. III 1985).

²⁷⁵ S. REP. NO. 166, 96th Cong., 2d Sess. 2, *reprinted in* 1980 U.S. CODE CONG. & ADMIN. NEWS 1743, 1744.

²⁷⁶ 50 U.S.C. app. §§ 2091-2092 (1982 & Supp. III 1985).

²⁷⁷ *Id.* § 2093.

²⁷⁸ 50 U.S.C. app. §§ 2181-2183 (1982).

²⁷⁹ *Id.* § 2182.

²⁸⁰ *Id.* § 2181.

²⁸¹ 50 U.S.C. §§ 98-100a (1982 & Supp. III 1985).

²⁸² *Id.* § 98a(b).

²⁸³ S. REP. NO. 201, 96th Cong., 1st Sess. 2, *reprinted in* 1979 U.S. CODE CONG. & ADMIN. NEWS 793, 794 [hereinafter S. REP. NO. 201].

²⁸⁴ *Id.*, *reprinted in* 1979 U.S. CODE CONG. & ADMIN. NEWS, at 794.

ditional materials at an estimated cost of \$12.5 billion.²⁸⁵ Furthermore, successive administrations have reoriented and significantly changed stockpile policy in recent years.²⁸⁶

C. The Failure to Implement a National Materials Policy

Despite Congress' professed concern over the United States dependency on foreign minerals,²⁸⁷ achievement of complete United States mineral self-sufficiency in the foreseeable future is not likely.²⁸⁸ Congressional and administrative policy decisions regarding mineral security are often shortsighted and contradictory and may vary depending on the government agency involved or the political party in power.²⁸⁹ Too often legislative and executive initiatives are fragmented and enacted without fully considering their impacts on the minerals industries and the industrial production of the United States.²⁹⁰ Congress also has failed to provide oversight to ensure

²⁸⁵ IMPLEMENTATION OF THE NATIONAL MINERALS AND MATERIALS POLICY, *supra* note 22, at 10.

²⁸⁶ S. REP. NO. 201, *supra* note 283, at 2, reprinted in 1979 U.S. CODE CONG. & ADMIN. NEWS, at 794.

²⁸⁷ 30 U.S.C. § 1601 (1982); *id.* § 1801 (Supp. III 1985).

²⁸⁸ TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 83-102.

²⁸⁹ U.S. MINERALS VULNERABILITY REPORT, *supra* note 19, at xi-xii.

²⁹⁰ *Id.* at 13; see also S. REP. NO. 897, *supra* note 2, at 5, reprinted in 1980 U.S. CODE CONG. & ADMIN. NEWS, at 4875. Federal departments and agencies pursue highly fragmented mineral activities that reflect departmental rather than national perspectives of minerals policy. S. REP. NO. 897, *supra* note 2, at 5-6, reprinted in 1980 U.S. CODE CONG. & ADMIN. NEWS, at 4875-76.

Congress too has played a role in the decline of America's mineral capabilities. Because of its fragmented policy process, Congress has failed to provide oversight, has not sought to understand how other legislation negatively affects the production of minerals, and has failed to check executive initiative oriented only toward other, and often conflicting, policy goals.

U.S. MINERALS VULNERABILITY REPORT, *supra* note 19, at 13.

The federal government, when establishing and implementing various energy and environmental policies, has done so without adequately recognizing the potential impacts on materials availability and the domestic mining industry. This situation is illustrated by the government's imposition of the vehicle fuel-economy standards. The government never evaluated the possible effects on the supplies and prices of basic materials required in automobile construction before adopting the automobile fuel efficiency standards. The standards, enacted to reduce United States' dependency upon foreign petroleum imports, may result in increased aluminum imports that may exceed the dollar value that can be saved by reducing oil imports. Thus, the United States balance-of-trade deficit would not improve. Furthermore, to meet the standards, automobile pollution control devices may require more rhodium than is normally available and cause a drastic price increase for this scarce metal. UNITED STATES GENERAL ACCOUNTING OFFICE, REPORT TO THE CONGRESS, POLICY CONFLICT—ENERGY, ENVIRONMENTAL, AND MATERIALS: AUTOMOTIVE FUEL-ECONOMY STANDARDS' IMPLICATION FOR MATERIALS, 13 (1980).

that its policies are implemented properly by executive agencies.²⁹¹ Because there is no federal policy-level advocate for minerals, the nation's mineral security has become dependent on the political process rather than the forces of the free market.²⁹²

Public land access restrictions, environmental, and health and safety regulations, political policy decisions, and administrative delay increase the cost of domestic mineral development and impede capitalization of increased mineral production.²⁹³ The federal government is pursuing a course of action that makes the development of a secure domestic mineral supply increasingly difficult if not impossible to achieve.²⁹⁴ As a result of conflicting federal actions, the United States lacks a coherent national materials policy to assure the availability of essential materials.²⁹⁵

V. MINERALS SUPPLY SECURITY

The increasing United States dependence on foreign sources for strategic and critical materials, and the success of the Organization of Petroleum Exporting Countries (OPEC) in both raising prices and exerting political pressure, has led to concern over the vulnerability of the United States to essential minerals supply interruption.²⁹⁶ The

²⁹¹ U.S. MINERALS VULNERABILITY REPORT, *supra* note 19, at 13.

²⁹² *See id.* at 16, 27.

²⁹³ *Hearings on Geopolitics of Strategic and Critical Materials*, *supra* note 197. There are four major laws that encourage the development of United States mineral resources. On the negative side, there are at least 26 environmental and anti-pollution laws that withdraw land from mineral exploration and severely control mining and mineral processing. *Id.* at 260.

²⁹⁴ U.S. MINERALS VULNERABILITY REPORT, *supra* note 19, at 27.

²⁹⁵ 30 U.S.C. § 1601(a)(6) (1982). *See also* GENERAL ACCOUNTING OFFICE, REPORT TO THE CONGRESS, MINERALS MANAGEMENT AT THE DEPARTMENT OF THE INTERIOR NEEDS COORDINATION AND ORGANIZATION (1981); ACTIONS TO PROMOTE A STABLE SUPPLY OF MINERALS, *supra* note 36; IMPLEMENTATION OF THE NATIONAL MINERALS AND MATERIALS POLICY, *supra* note 22; LEARNING TO LOOK AHEAD, *supra* note 4; GENERAL ACCOUNTING OFFICE, REPORT TO THE CONGRESS, NEED TO DEVELOP A NATIONAL NON-FUEL-MINERAL POLICY (1976).

²⁹⁶ TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 84. *See also* Lewin, *Washington Window*, 103 MECHANICAL ENGINEERING 79 (1985). The oil embargo emphasized United States dependency on oil imports and the ability of foreign suppliers to disrupt a commodity market. This political use of economic resources has paved the way for attempts at a worldwide economic realignment, based on the control and distribution of all natural resources. As the impact of the oil crisis on the American economy deepened, concern grew as to the continued availability of the nation's imports of other minerals necessary for a highly industrialized society. Plotkin, *The United States and South Africa: The Strategic Connection*, 85 CURRENT HIST. 201 (1986).

There are essential differences between nonfuel minerals and oil. First, minerals are cheaper and are used in far smaller quantities per unit of final output than oil, and, therefore, are easier to stockpile. Shafer, *supra* note 81, at 155-56. It is not practicable for the United States

United States vulnerability to materials supply interruption is a post-World War II problem.²⁹⁷ For its first 150 years, the United States was almost totally self-sufficient for its own mineral needs.²⁹⁸ Since the Second World War, however, three important changes have occurred in world politics and trade.²⁹⁹ The first international change was the rapid increase in the rate of metals consumption.³⁰⁰ At present consumption rates, mankind will consume more metal in the next 25 years than has been consumed to date.³⁰¹ The second world change was the explosion in technology that increased demand for metals over that required by our pre-war standard of living.³⁰² Finally, worldwide decolonization led to the establishment of new developing countries that became the owners of mineral deposits and realigned the priorities and concerns of the world's mineral supply system.³⁰³

Prolonged supply interruption of certain strategic and critical minerals would jeopardize the security of the industrialized world. A materials industry representative concluded in congressional testimony that curtailing certain vital minerals for six months to one year would seriously imperil the Western world or "bring it to its knees."³⁰⁴

Import dependence, defined as the percentage of demand supplied by foreign sources, is not the same as vulnerability to supply interruption.³⁰⁵ The stability, reliability, and diversity of foreign sources of supply are major factors in determining whether the United States is vulnerable to supply disruptions of a particular imported min-

to store an entire year's consumption of oil, but the nation could stockpile a one year reserve of strategic minerals. *Id.* Second, there is no substitute for petroleum as fuel for the combustion engine. *Id.*

²⁹⁷ *Hearings on Geopolitics of Strategic and Critical Materials*, *supra* note 197, at 67 (statement of E.F. Andrews, Vice President, Material and Services, Allegheny International, Inc.).

²⁹⁸ U.S. MINERALS VULNERABILITY REPORT, *supra* note 19, at 5.

²⁹⁹ *Hearings on Geopolitics of Strategic and Critical Materials*, *supra* note 197, at 67 (statement of E.F. Andrews, Vice President, Material and Services, Allegheny International, Inc.).

³⁰⁰ *Id.*

³⁰¹ *Id.*

³⁰² *Id.* at 68.

³⁰³ *Id.*

³⁰⁴ NONFUEL MINERALS POLICY REVIEW, PART II, *supra* note 43, at 48, 56. For a discussion on United States vulnerability to minerals supply interruptions, see Hazilla & Kopp, *Assessing U.S. Vulnerability to Raw Material Supply Disruptions: An Application to Nonfuel Minerals*, 51 S. ECON. J. 341 (1984).

³⁰⁵ See TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 83.

eral.³⁰⁶ The majority of United States minerals imports come from reliable sources, either allies or close neighbors. For a few specific minerals, however, the United States is highly dependent on a limited number of potentially unstable foreign sources. Domestic strikes can interrupt supplies even from sources regarded as reliable. Other sources, such as imports from Australia, are vulnerable because the supply lines are so long.³⁰⁷ This section discusses the major factors that affect security of supply, provides examples of materials supply interruptions since World War II, and gives a brief analysis of the effects of past supply interruptions.

A. Factors That Affect Security of Supply

1. Depletion of World Resources

The depletion of world resources in the face of escalating demand is a concern expressed especially during periods of tight supplies and high prices, as was the case in the oil embargo of 1973-1974.³⁰⁸ Resource depletion forecasts, however, do not stand up to close scrutiny. Supporters of resource exhaustion theories have not recognized prices as a motive to increase mineral reserves nor as a motive to economize use of material resources, develop substitutes, or recycle.³⁰⁹ Another weakness in scarcity forecasts is that they are often based on available proven reserves (reserves are resources that can be mined economically at current prices and technology), ignoring the continuing development of new reserves.³¹⁰ Such predictions have not recognized that reserves represent available supply in the short term and that the long term reserve base is being expanded continually through price changes, new deposits discovery, and new technology development.³¹¹ For example, through techno-

³⁰⁶ *Id.* at 48-50, 83.

³⁰⁷ *Id.*

³⁰⁸ Murphy, *supra* note 30, at 192.

³⁰⁹ *Id.*

³¹⁰ *Id.*

³¹¹ *Id.* See also TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 84. New mineral deposits are continually adding to the reserve base. For example, a minerals engineer claims to have discovered a substantial deposit of rare titanium along a beach near the San Francisco zoo. *Titanium Find is in "Millions of Tons"*, *Deseret News*, Nov. 24, 1986, at A5, col. 2. Titanium is a noncorrosive metal used in the construction of weapons and aircraft. *Id.* The largest deposits are found in the Soviet Union and South Africa. *Id.* The United States imports most of its supply from Australia at approximately \$30 a pound. *Id.* at A5, col. 3. Government restrictions may impede development of the deposit. "The exploration site is on land belonging to the National Park Service and in waters under the jurisdiction of

logical advances, many lower quality ores are now "just as usable as the richer ones were before them."³¹² World reserves, therefore, are only the "tip of the iceberg" in comparison with world resources.³¹³

The earth's resources are finite and therefore potentially exhaustible.³¹⁴ The best available information, however, indicates that there are sufficient minerals to meet the world's needs for at least the next thirty to fifty years.³¹⁵ Many areas of the world have not been explored for mineral potential.³¹⁶ Substantial mineral resources are estimated to exist in the Arctic regions, the Soviet Union, China, and Brazil.³¹⁷ In addition, the mineral potential of the oceans is considerable, particularly for nickel, copper, cobalt, and manganese.³¹⁸

The optimistic longer term minerals supplies outlook does not mean that technology can extend the life of the earth's resources indefinitely.³¹⁹ According to one geophysical theory, most metals have a "mineralogical barrier" beyond which the energy needed to release them from the rocks in which they are bound is so great and the prices so high that new supplies of these metals will no longer be produced.³²⁰ World resources depletion, however, is not likely in

State Lands Commission and any extraction operation would require approval by numerous state and federal agencies." *Id.* at A5, col. 4.

³¹² TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 84.

³¹³ See Murphy, *supra* note 30, at 192.

³¹⁴ TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 84.

³¹⁵ *Id.* See also Murphy, *supra* note 30, at 192.

³¹⁶ Murphy, *supra* note 30, at 192.

³¹⁷ *Id.*

³¹⁸ *Id.*; 30 U.S.C. § 1401(a)(4) (1982).

³¹⁹ Murphy, *supra* note 30, at 192; see also TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 84.

³²⁰ TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 85. The mineralogical barrier may be reached for all but five geochemically scarce metals within a century.

The Earth's crust contains just 12 "geochemically abundant" elements, which account for over 99 percent of the mass. Five of these elements are metals: aluminum, iron, magnesium, titanium, and manganese. A steadily increasing amount of energy will be needed to produce even these metals from progressively leaner ores. But for all the other metals, a mineralogical barrier may exist, usually at ore concentrations of about one-tenth to one-hundredth of 1 percent, past which the metal is no longer concentrated in an ore body. Instead, it is dispersed as atoms, isomorphically replacing atoms of the abundant elements in common rocks. Once the mineralogical barrier is reached, the energy needed to release the scarce metals will be so great, and the prices so high, that according to the theory, new supplies of these metals will no longer be produced. According to this theory, a "Second Iron Age" will begin when "it will be simply cheaper to substitute iron and aluminum and put up with penalties, such as lower efficiencies in machines, that we do not now countenance."

Id.

the physical "running out" of reserves but as a persistent long-term rise in materials costs.³²¹ Although minerals depletion is in fact occurring, the loss at this time is not crucial.³²² As long as fossil fuels are abundant, technological advances will bring continued growth in the world's minerals reserves.³²³

2. Demand Surges

Temporary shortages and price increases for materials in response to unusual demand surges are infrequent, short-lived, but disruptive experiences to the economies of industrialized countries.³²⁴ The problems of productive capacity are largely the result of market force unpredictability and the difficulties in forecasting demand trends.³²⁵ The recent relatively slow growth in economic activity in the United States has produced overcapacity and low prices for many minerals.³²⁶ An unexpected and sustained surge in demand, however, could outstrip current capacity and lead to supply shortages.³²⁷ Problems stemming from such surges could be avoided only by stockpiling the materials at substantial cost.³²⁸ The materials may be stored for decades before being needed.³²⁹ Furthermore, it is impossible to project demand trends accurately for the two to seven years needed to open new mines, processing plants, and support facilities, and the risk of investing in excess capacity is unusually high.³³⁰ In the case of most commodities, therefore, industries underinvest during prolonged periods of low demand, and industries dependent upon the minerals may experience supply dislocations during a demand surge and resulting inadequate production capacity.³³¹

3. Cartels

In cartels, "producing companies . . . formally agree to control production, exports, or selling prices to restrict competition and

³²¹ *Id.*

³²² *Id.*

³²³ *See id.* at 84-85.

³²⁴ Murphy, *supra* note 30, at 192-93; TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 5.

³²⁵ *See* Murphy, *supra* note 30, at 193.

³²⁶ *Id.*

³²⁷ *Id.*

³²⁸ *Id.*

³²⁹ *Id.*

³³⁰ *Id.*; *see also* TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 86.

³³¹ Murphy, *supra* note 30, at 193; TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 86.

obtain higher export earning."³³² The United States' increasing dependence on foreign sources for strategic and critical materials, and the success of OPEC in both raising prices and exerting political pressure, have led to concern over the vulnerability to the possible formation of minerals and materials cartels.³³³

Some of the conditions for a successful minerals cartel exist for several nonfuel minerals. There is a limited number of suppliers, and some minerals are essential for certain industries and presently have no effective substitution.³³⁴ There are, however, several reasons why these conditions are not enough to create a successful cartel for most nonfuel minerals. First, the total cost of United States nonfuel minerals imports, compared with oil, is small.³³⁵ Second, most nonfuel minerals are easier to store than oil, enabling users to stockpile the commodity.³³⁶ Most minerals-using industries store essential minerals, and the federal government has a one- to three-year reserve of many critical materials to meet national defense needs in an emergency.³³⁷ Third, markets for most nonfuel minerals have been depressed since the mid-1970s.³³⁸ Fourth, many producer countries are dependent on foreign exchange earnings from minerals exports.³³⁹ Finally, and most importantly, producer countries as diverse in ideology and goals as Zimbabwe, South Africa, and the Soviet Union do not share a similarity of political objectives and economic conditions to cooperate in a cohesive organization that sets production controls and prices.³⁴⁰

Producers of copper and bauxite organized a cartel to restrict supply and raise prices in 1974 and 1975. The effort to monopolize copper production undertaken by members of the International Council of Copper Exporting Countries (CIPEC) was a failure.³⁴¹

³³² TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 86.

³³³ CONGRESSIONAL HANDBOOK, *supra* note 18, at 149.

³³⁴ *Id.*

³³⁵ *Id.*

³³⁶ *Id.*

³³⁷ *Id.*

³³⁸ *Id.*

³³⁹ *Id.*

³⁴⁰ *Id.* at 86-87; see also CONGRESSIONAL HANDBOOK, *supra* note 18, at 145-48; Shafer, *supra* note 81, at 160-61.

³⁴¹ TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 87. There are numerous limits on the potential for an effective copper cartel. CONGRESSIONAL HANDBOOK, *supra* note 18, at 150-52. First, a large number of copper producers exist. *Id.* at 151. Second, the CIPEC countries are highly dependent on foreign trade revenues from copper. *Id.* Third, copper resources are widely distributed throughout the world. *Id.* Fourth, other materials may be substituted for copper. *Id.* at 152. Finally, CIPEC included diverse nations—Chile, Zambia, Zaire and Peru—who lacked the necessary cohesion for a successful cartel. *Id.* at 150, 152.

Efforts to increase prices by the International Bauxite Association (IBA) were more successful. Most members increased their bauxite exports earnings by over 200 percent during 1974 and 1975.³⁴² Jamaica's imposition of sharply higher bauxite exports taxes was particularly successful.³⁴³ The tax was successful because United States' aluminum producers had no alternative supplier as convenient as nearby Jamaica, and the cost of bauxite is a small fraction of the cost of aluminum.³⁴⁴

The fact that minerals cartels have failed in the past does not mean that they will not succeed in the future. Factors impeding successful cartel formation are the lack of common goals among producing countries, the existence of stockpiles and substitutes, and the threat of new, alternate sources of supply.³⁴⁵ One of the classic conditions for monopoly control exists for some significant nonfuel minerals—the fact that a few important minerals are produced by a limited number of supplier nations.³⁴⁶ Chromium, manganese, cobalt, and platinum group metals have the potential for cartel formation because the United States is import dependent on these metals and production is concentrated in southern Africa and the Soviet Union.³⁴⁷

4. Political Embargoes

Increased control over natural resources is becoming a major objective of developing countries in their efforts to gain a worldwide economic realignment between industrialized and developing countries. Developing nations seek to transform the industrialized countries dependence on imported raw materials into higher commodity prices and enhanced political influence on international affairs.³⁴⁸ This transformation creates “a ‘new international economic order . . . ,’ in which some mineral-producing countries have nationalized foreign mineral interest and have threatened to deny raw materials if their economic and social demands are not met.”³⁴⁹ South African government officials, including President P.W. Botha, have suggested several times that if the international community imposed severe sanc-

³⁴² CONGRESSIONAL HANDBOOK, *supra* note 18, at 153.

³⁴³ TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 87.

³⁴⁴ *Id.*

³⁴⁵ *Id.*

³⁴⁶ *Id.* at 86–87.

³⁴⁷ CONGRESSIONAL HANDBOOK, *supra* note 18, at 160–63.

³⁴⁸ Murphy, *supra* note 30, at 193.

³⁴⁹ *Hearings on the U.S. Stake in the Global Economy*, *supra* note 3, at 16.

tions against South Africa, the country might retaliate by withholding mineral supplies from the world market.³⁵⁰ Governments, including the United States, limit world trade in minerals to advance political objectives.³⁵¹ From 1966 to 1971, the United States supported United Nations sanctions against the former British colony of Rhodesia and imposed a boycott of Rhodesian chrome because the country refused to grant blacks equal participation in its government.³⁵² Since the Cuban Revolution in the 1950s, the United States has also prohibited imports of nickel and other materials from that country as well.³⁵³

Nevertheless, excluding boycotts adopted by the United States, embargoes of raw materials are unlikely because producing countries depend too heavily on revenue from their mineral exports to endanger that income by imposing an embargo.³⁵⁴ Embargoes are counterproductive to producers' revenue goals because they deny the commodity but do not increase revenue.³⁵⁵ An embargo, however, may be undertaken for political reasons such as the Arab oil embargo of 1973-1974.³⁵⁶ If a politically motivated embargo is to be successful, the producing countries must have common political objectives and economic power.³⁵⁷ This combination of factors is only present in the Arab OPEC countries and is not found in any other group of countries producing nonfuel minerals.³⁵⁸

5. The Resource War

Nations and kingdoms have sent explorers, generals, and colonizers to discover, conquer, and exploit the mineral rich regions of the globe.³⁵⁹ "For most of the 20th century access to raw materials has

³⁵⁰ Willenson & Getz, *The Mines of Apartheid: Can the West do Without South Africa's Minerals?*, NEWSWEEK, Aug. 11, 1986, at 30; see also STAFF OF SENATE COMM. ON FOREIGN RELATIONS, 97TH CONG., 2D SESS., A REPORT ON U.S. MINERALS DEPENDENCE ON SOUTH AFRICA 10 (Comm. Print 1982) [hereinafter A REPORT ON U.S. MINERALS DEPENDENCE ON SOUTH AFRICA].

³⁵¹ TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 87.

³⁵² *Id.*

³⁵³ *Id.*

³⁵⁴ Murphy, *supra* note 30, at 193; see *Don't Lose Sleep Over Strategic Metals*, FORTUNE, Sept. 30, 1985, at 23 [hereinafter *Don't Lose Sleep*]. "Mining accounts for about 26% of South Africa's gross domestic product and 75% of its foreign exchange earnings . . ." *Id.*

³⁵⁵ Murphy, *supra* note 30, at 193.

³⁵⁶ *Id.*

³⁵⁷ *Id.*

³⁵⁸ *Id.*

³⁵⁹ Earney, *The Geopolitics of Minerals*, 31 FOCUS 1 (1981).

been associated with wars and military conflict."³⁶⁰ One commentator has suggested that the origins of the past two world wars may be traced in part to the dearth of natural resources available to the axis powers.³⁶¹ Certainly numerous military decisions in World War II were based on the need to acquire or to deny access to various mineral resources.³⁶² Today, geopolitical situations exist in which minerals are the focus of conflict.³⁶³ Some analysts claim that a

³⁶⁰ *Hearings on Geopolitics of Strategic and Critical Materials*, *supra* note 197, at 80 (statement of Dr. Daniel I. Fine, Research Associate, Mining and Materials Resource Research Institute, Massachusetts Institute of Technology). *See also* Kemp, *Scarcity and Strategy*, 56 FOREIGN AFF. 396 (1978).

³⁶¹ A. ECKES, THE UNITED STATES AND THE GLOBAL STRUGGLE FOR MINERALS 3-25, 57-87, 89-119 (1979).

The acquisition of alternate sources of raw materials played a part in initiating World War I. German historian Fritz Fischer writes that his country's decision to enter the first global war was a desperate attempt to achieve a world position equal to that of Britain or France. He maintains that German war aims included the acquisition of specific raw material sources—possession of iron from French Lorraine; iron, coal, and manganese from the Ukraine; and other resources from Belgium, Turkey, and African colonies. *See id.* at 3-35.

Similarly, there is a link between mineral deficiencies in the Axis nations of Germany, Japan, and Italy in World War II. *Id.* at 58-59, 260. In the prewar period, these nations repeatedly asserted that the uneven distribution of raw materials among industrial states was inequitable and intolerable. *Id.* As late as 1939, Britain and the United States controlled over 75% of all mineral resources, while the dissatisfied Axis powers held only 11%. *Id.* Facing increased population growth and domestic demands for higher living standards, the three countries concluded that war was an acceptable alternative to acquire needed sources of raw materials and achieve lasting economic growth. *See id.* at 57-87, 89-119.

A secure supply of minerals resources is so important that an argument was made in 1943 to the effect that the combined mineral resources of the British Empire and the United States, together with control of the sea and air, was the basis for collective action to prevent future wars in the post World War II era. *Hearings on Geopolitics of Strategic and Critical Materials*, *supra* note 197, at 80 (statement of Dr. Daniel I. Fine, Research Associate, Mining and Minerals Resource Research Institute, Massachusetts Institute of Technology).

³⁶² A. ECKES, *supra* note 361; Dumett, *Africa's Strategic Minerals During the Second World War*, 26 J. AFRICAN HIST. 381 (1985).

One important cause of the Second World War was the competition for control of the world's strategic minerals. Dumett, *supra*, at 381. To wage total war required the extraction of raw materials from all continents on an unprecedented scale. *Id.* The early success of Axis offensives, which were influenced by the drive to control mineral reserves, produced great concern among the Allies. *Id.* Control over world resources was an important element of the Allied plan for victory. *Id.* Since the Germans dominated continental Europe, the Allies had to meet their raw material requirements from Africa and other regions of the world. *Id.* Africa's minerals were used in Allied rearmament and wartime munitions production and were significantly more important than the continent's political position and general level of economic development. *Id.* at 381-82. "Indeed, it is possible to argue, because of its dominance in the supply of certain critical minerals, that African production was absolutely essential for the Allied war effort." *Id.* at 382.

³⁶³ Russett, *Security and the Resources Scramble: Will 1984 Be Like 1914?*, 58 INT'L AFF. 42 (1981-82). Just as assured access to raw materials was a driving force in the outbreak of the First and Second World Wars, present-day international conflict could result from attempts

"resource war" is being waged by the Soviet Union to gain control of both Mideastern oil and southern African minerals, and to threaten the United States and its allies with the loss of these critical materials.³⁶⁴

Although the term "resource war" is used rather loosely by experts discussing Soviet objectives, it has been described as "the acquisition of vital resources by noneconomic means; . . . a pernicious form of 'economic cannibalism,' designed to destroy the process of economic activity outside the Soviet bloc."³⁶⁵ It is "a strategy of confrontation that extends beyond economic competition, but which falls just short of conventional military conflict."³⁶⁶ "Resource war" also refers to the economic deployment of Soviet Union mineral resources.³⁶⁷ In 1982, the Soviet Union "dumped" (sold below cost) substantial amounts of nickel into depressed world nickel markets.³⁶⁸ Canada, a major nickel producer, lost the Western nickel market to Soviet exports, thereby creating economic hardship in Canada's mining regions as mines closed and thousands of miners were laid off.³⁶⁹ Private industry cannot afford to sell its product below cost for a long-term period.³⁷⁰ A nation, however, can absorb such losses to achieve political objectives.³⁷¹ Frank Shakespeare, former director of the United States Information Agency, has stated: "When we [the United States] jostle with Western Europe and Japan for strategic minerals—that's competition. When the Russians get into the act—that's war."³⁷²

to acquire or maintain secure sources of raw materials. *Id.* at 48. The creation of the American Rapid Deployment Force was a direct response to a perceived need to protect Persian Gulf oil supplies, which are vital to the economic and security interests of the Western industrialized world. *Id.*

³⁶⁴ TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 41, 87.

³⁶⁵ NONFUEL MINERALS POLICY REVIEW, PART III, *supra* note 15, at 1 (remarks of Rep. James Santini, Nev.).

³⁶⁶ *Id.* American dependence on raw materials imported by ship has enhanced the United States Navy's role as guardian of the world's maritime trade routes. Klare, *Resource Wars*, HARPER'S, Jan. 1981, at 20-23. The Navy has advocated an unlimited expansion program to meet the challenge of likely resource wars. *Id.* A proposed Fifth Fleet in the Indian Ocean to protect Persian Gulf oil supplies is currently being discussed. *Id.* For additional discussion on resource scarcity and international conflict, see P. CONNELLY & R. PERLMAN, *THE POLITICS OF SCARCITY: RESOURCE CONFLICTS IN INTERNATIONAL RELATIONS* (1975).

³⁶⁷ *Hearings on Geopolitics of Strategic and Critical Materials*, *supra* note 197, at 84 (statement of Dr. Daniel I. Fine, Research Associate, Mining and Mineral Resource Research Institute, Massachusetts Institute of Technology).

³⁶⁸ *Id.*

³⁶⁹ *Id.*

³⁷⁰ *Id.*

³⁷¹ *Id.*

³⁷² Meyer, *Russia's Sudden Reach for Raw Materials*, FORTUNE, July 28, 1980, at 43, 44.

Evidence of Soviet intent to wage a "resource war" lies in political statements by Soviet leaders, and Soviet projection of military power around the world that could disrupt supplies of vital raw materials to the United States and its allies.³⁷³ In 1972, the late Leonid Brezhnev said while visiting Somalia: "Our aim is to get control of the two great treasure houses on which the West so vitally depends, the energy treasury house of the Persian Gulf and the mineral treasury house of Central and Southern Africa."³⁷⁴ Some argue that the Soviet military presence indicates a clear intent to gain control over Persian Gulf petroleum and southern Africa's mineral resources.³⁷⁵ The virtual encirclement of the Persian Gulf and southern Africa by countries either dominated by or leaning to the Soviet Union supports this argument.³⁷⁶ This argument points to the Soviet invasion of Afghanistan, Soviet influence and the presence of Cuban and East German troops and advisors in Angola and other African nations, and the expansion of the Soviet navy as elements of the strategy.³⁷⁷

Direct parallels also exist in the Caribbean, through which a large portion of United States and critical materials are shipped. President Reagan has warned about the spread of Marxist influence from Cuba and Nicaragua to El Salvador, Guatemala, and ultimately Mexico. Long-term Soviet objectives include Soviet influence over Mexican

³⁷³ *Hearings on Geopolitics of Strategic and Critical Materials*, *supra* note 197, at 9 (statement of Sen. John W. Warner, Virginia).

³⁷⁴ *Id.* at 69 (statement of E.F. Andrews, Vice President, Material and Services, Allegheny International, Inc.). Mr. Brezhnev was not the first leader in the Soviet hierarchy to state that Soviet policy includes getting control of the raw materials on which the West depends. *Id.* Joseph Stalin made similar statements. *Id.* In 1921, Stalin said: "That victory over the United States and Europe would be facilitated by uprisings in the Middle East and Africa which would deprive the 'imperialist' from essential raw materials." *Id.* In 1957, Major General Lagovsky supported this objective when he stated: "The policy should be to link the Middle East and Central and Southern Africa into one single, super theater of peaceful warfare so that they might obstruct the West from access to both the oil and strategic metals of the areas." *Id.*

³⁷⁵ *Id.* at 9 (statement of Sen. John W. Warner, Virginia).

³⁷⁶ *Id.* at 69 (statement of E.F. Andrews, Vice President, Material and Services, Allegheny International, Inc.).

³⁷⁷ TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 87; *Hearings on Geopolitics of Strategic and Critical Materials*, *supra* note 197, at 253. The Soviets and their East German and Cuban surrogates have approximately 44,000 military personnel encircling or within southern Africa and about 8,000 troops and advisors in the Mideast and North African regions. *Hearings on Geopolitics of Strategic and Critical Materials*, *supra* note 197, at 5 (statement of Sen. James A. McClure, Idaho). Soviet supported military interventions have already occurred in Angola, Ethiopia, Mozambique, and Zaire. *Id.* at 253. A Marxist-oriented government is in power in Zimbabwe, and covert or subversive Soviet operations exist in Namibia, South Africa, and Zaire's Shaba Province. *Id.*

and Venezuelan oil shipments, strategic Caribbean sea lanes, and the Panama Canal.³⁷⁸

The "resource war" argument encompasses a second scenario.³⁷⁹ Soviet critical materials exports are declining sharply, and the Soviet Union has begun to import strategic minerals for itself and its allies.³⁸⁰ According to this scenario, "the Soviet Union plans to rely on political and military domination of Africa rather than on costly economic competition with Western nations to get the resources it needs."³⁸¹

Although the Soviet Union may see benefits in controlling these resources, some analysts do not believe that Soviet activities in Africa are part of a grand design to obtain minerals for themselves and deny resources to the West.³⁸² These observers maintain that "a scenario in which the Soviets used direct force in South Africa or elsewhere in southern Africa to cut off minerals production or in which they interdicted shipping from the region would almost certainly take place in the context of much larger hostilities."³⁸³ Such hostilities would almost certainly involve the interruption of petroleum from the Persian Gulf which is closer to the Soviet Union and its military power. Furthermore, Mideast oil supply interruption would be more devastating to the West than the loss of the strategic minerals produced in South Africa. Therefore, these observers argue, unilateral Soviet military action to cut off mineral exports from southern Africa to the West is not as likely as the Soviet use of force to disrupt Mideast oil that is nearby and is the West's lifeblood.³⁸⁴ Even if there were a Marxist takeover in South Africa, moreover, there is little evidence that Marxist states will give up the foreign

³⁷⁸ *Hearings on Geopolitics of Strategic and Critical Materials*, *supra* note 197, at 253.

³⁷⁹ *TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY*, *supra* note 4, at 88.

³⁸⁰ S. REP. NO. 897, *supra* note 2, at 3, *reprinted in* 1980 U.S. CODE CONG. & ADMIN. NEWS, at 4873. The quality of Soviet mineral ores have declined and new minerals exploration has moved into the forbidding Siberian environment. *TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY*, *supra* note 4, at 90.

³⁸¹ *TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY*, *supra* note 4, at 88. Some observers disagree with the conclusion that the Soviet Union is rapidly increasing its dependence on imports of strategic minerals. *Id.* at 89-90. They believe that recent Soviet imports for some minerals and the cessation of the sale of others are the "consequences of poor Soviet planning, shoddy maintenance of facilities, and low production efficiency," and do not signify a minerals shortage that could result in a resource war. *Id.*

³⁸² *Id.* at 88; Shafer, *supra* note 81, at 159; *Hearings on Geopolitics of Strategic and Critical Materials*, *supra* note 197, at 92 (statement of Leonard L. Fischman, President, Economic Associates, Inc.).

³⁸³ A REPORT ON U.S. MINERALS DEPENDENCE ON SOUTH AFRICA, *supra* note 350, at 7.

³⁸⁴ *Id.*; *TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY*, *supra* note 4, at 88.

exchange they derive from minerals exports for foreign policy reasons. For example, in Marxist Angola, Cuban troops guard oil installations in the Cabinda Province, where oil flows from Angola to the Western world.³⁸⁵

Nevertheless, analysts believe that by direct military intervention, support of Marxist governments and insurgent movements, or by fomenting instability, the Soviet Union is positioning itself so that it could deny the critical minerals supply from southern Africa to the United States and its allies.³⁸⁶ The Soviet Union is far more self-sufficient in essential minerals supplies than is the West.³⁸⁷ An em-

³⁸⁵ A REPORT ON U.S. MINERALS DEPENDENCE ON SOUTH AFRICA, *supra* note 350, at 8; see also TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 88; Shafer, *supra* note 81, at 159-60. Despite Marxist rhetoric, there are numerous examples of Communist nations exporting their mineral resources to the West. A REPORT ON U.S. MINERALS DEPENDENCE ON SOUTH AFRICA, *supra* note 350, at 8. This includes exports of East European coal, Soviet gas, and Chilean copper under the Allende government. Cuba would willingly export its nickel to the United States if it was not prevented by the American trade embargo with that country. *Id.*

³⁸⁶ *Hearings on Geopolitics of Strategic and Critical Materials*, *supra* note 197, at 253. There is evidence to support the position that a Marxist takeover of South Africa could jeopardize the West's supply of minerals on foreign policy grounds. A REPORT ON U.S. MINERALS DEPENDENCE ON SOUTH AFRICA, *supra* note 350, at 7-8. A Marxist South African government may embargo supplies in concert with the Soviet Union, the other major source of several critical minerals, in order to support a Soviet foreign policy objective that they share. *Id.* There is certainly ample experience of such supply disruption when the Arab states pursued a common foreign policy goal and embargoed petroleum exports to the United States to force a change in American policy favoring Israel in the Mideast conflict. *Id.* at 8. Furthermore, revolutionary governments may mismanage their mineral resources and cause breakdowns in mine production, or frighten off foreign investment and skilled labor by implementing misguided commercial policies that lack incentives to attract foreign capital and skilled workers. *Hearings on Geopolitics of Strategic and Critical Materials*, *supra* note 197, at 93 (statement of Leonard L. Fischman, President, Economic Associates, Inc.).

The more likely danger from Soviet influence will be the result of South African support of insurgent movements in neighboring black states—Zambia, Angola, and Mozambique—and South Africa's failure to undergo a transition from white to black rule. TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 88. The danger is that to defend themselves from the insurgents and to provide aid to opposition groups in South Africa, these nations might become increasingly dependent on Soviet military assistance and might then be forced into a subservient client-state relationship. *Id.*; Sparks, *Harare Stepping up Rebel Fight*, *The Washington Post*, Nov. 19, 1986, at A21, col. 1.

³⁸⁷ S. REP. NO. 897, *supra* note 2, at 3, reprinted in 1980 U.S. CODE CONG. & ADMIN. NEWS, at 4873. The United States is self-sufficient in only 5 of the 27 non-fuel minerals generally considered to be strategic. The Soviet Union is self-sufficient in 21 of 27 such strategic minerals. *Sagebrush Rebellion Hearing*, *supra* note 122, at 147 (statement of Dean William Dresher, College of Mines, University of Arizona, and Director, State of Arizona, Bureau of Geology and Mining Technology). A more serious problem is the far greater dependence of United States allies upon supplies of foreign raw materials. In 1980, Western Europe imported about 80% of its mineral needs and Japan imported about 95% of its mineral needs. Calingaert, *U.S. Strategic Minerals Dependency*, 81 DEP'T STATE BULL. 23 (Apr. 1981); see also *Hearings on Geopolitics of Strategic and Critical Materials*, *supra* note 197,

bargo of southern African minerals could put the United States and its allies in an even more vulnerable position with regard to the world's strategic minerals access.³⁸⁸ "Without adequate and dependable mineral supplies . . . the free world would be jeopardized."³⁸⁹

The United States imports \$1.4 billion worth of four critical minerals—chromium, cobalt, manganese, platinum group metals—each year.³⁹⁰ The United States depends on southern Africa's minerals for fifty-five percent of its chromium, fifty-three percent of its manganese, fifty-three percent of its platinum group metals, fifty-five percent of its vanadium, and fifty-five percent of its cobalt.³⁹¹ Therefore, "[a] long-term cutoff of any or all of these materials has the potential for an economic and strategic disaster worse than the oil crisis of the 1970s."³⁹² The embargo of South African minerals to the United States would affect 3.2 million American jobs in the steel, aerospace, and petroleum industries.³⁹³

6. Civil Disturbances, Local Wars, and Internal Troubles

Civil disorder, insurrection, invasion, labor strikes, sabotage, and terrorism, in the past, have threatened the security of minerals supply from southern Africa. Most analysts believe that these disturbances are the greatest threats to a dependable supply of minerals exports to the West in the foreseeable future.³⁹⁴ The threat to transportation interruption is another problem affecting southern Africa's minerals security.³⁹⁵ Minerals produced in central and southern African nations such as Zaire, Zambia, and Zimbabwe are shipped by

at 4 (statement of Sen. James A. McClure, Idaho). "This vulnerability of Western Europe and Japan is the greatest strategic minerals threat facing America." Shafer, *supra* note 81, at 163.

³⁸⁸ S. REP. NO. 897, *supra* note 2, at 3, reprinted in 1980 U.S. CODE CONG. & ADMIN. NEWS, at 4873.

³⁸⁹ U.S. MINERALS VULNERABILITY REPORT, *supra* note 19, at 1.

³⁹⁰ England & Gertz, *Metals More Precious Than Diamonds*, Washington Times, Sept. 30, 1985, at 52, 54.

³⁹¹ *Hearings on Geopolitics of Strategic and Critical Materials*, *supra* note 197, at 5 (statement of Sen. James A. McClure, Idaho); *Don't Lose Sleep*, *supra* note 354.

³⁹² *Hearings on Nat'l Critical Materials Act*, *supra* note 3, at 83 (remarks of Rep. George E. Brown, Jr., California).

³⁹³ England & Gertz, *supra* note 390, at 54.

³⁹⁴ TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 90; see also *Hearings on Geopolitics of Strategic and Critical Materials*, *supra* note 197, at 71 (statement of E.F. Andrews, Vice President, Material and Services, Allegheny International, Inc.).

³⁹⁵ *Hearings on Geopolitics of Strategic and Critical Materials*, *supra* note 197, at 71 (statement of E.F. Andrews, Vice President, Material and Services, Allegheny International, Inc.).

rail to South African ports.³⁹⁶ In fact, the supply of Zairian cobalt has been threatened by insurrection. Zaire's mineral rich Shaba province was occupied briefly by rebel forces in 1978 with serious consequences for the world cobalt market.³⁹⁷

South African society is in a state of civil disorder as the government resists pressure for dismantling the system of apartheid and moving from white minority rule to black rule.³⁹⁸ This civil disorder has already caused an increased number of strikes, protesting social conditions rather than employment problems, incidents of terrorism by groups operating under the loose organization of the African National Congress, and spontaneous mass violence.³⁹⁹ White or black protest over South African political policies and social conditions could result in increased strike activity or industrial sabotage, either of which would slow minerals production.⁴⁰⁰

In addition to labor unrest, minerals production could also be interrupted by increased acts of terrorism in South Africa. Terrorist acts can have an impact on the mining and minerals processing sector either by being targeted as a highly visible and important sector of the economy or by triggering the exodus of trained white professionals.⁴⁰¹ The 1980 attack on South Africa's synthetic oil project indicates that economic targets are vulnerable to terrorism.⁴⁰²

While labor unrest or internal violence could have short-term disruptive effects on South Africa's ability to produce and supply strategic minerals to the West, a major social breakdown could produce a long-term supply interruption or a decrease in production.⁴⁰³ South Africa is on the edge of a major social upheaval with profoundly disruptive effects on mineral supplies. The National Party government, in power since 1948, supports the continuation of apartheid and the homelands policy, both of which are repugnant to the majority black population. One white South African business leader has remarked about the failure of government policy: "The

³⁹⁶ *Hearings on Nat'l Critical Materials Act*, *supra* note 3, at 83 (remarks of Rep. George E. Brown, Jr., California); TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 90.

³⁹⁷ TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 90.

³⁹⁸ *Id.*; A REPORT ON U.S. MINERALS DEPENDENCE ON SOUTH AFRICA, *supra* note 350, at 11-12.

³⁹⁹ A REPORT ON U.S. MINERALS DEPENDENCE ON SOUTH AFRICA, *supra* note 350, at 11-12.

⁴⁰⁰ *Id.* at 12-13.

⁴⁰¹ *Id.* at 13.

⁴⁰² *Id.*

⁴⁰³ *Id.* at 14.

government mistakenly believes that it can have economic integration with political separation. It cannot work."⁴⁰⁴

Even friendly nations cannot be assumed to be safe and secure minerals trading partners.⁴⁰⁵ Allies like Canada and Mexico have experienced miners' strikes, export restrictions, and minerals industry nationalization that have impacted minerals exports to the United States.⁴⁰⁶ Nations who freely trade with the United States may undergo a change of government, thereby altering their cooperative export minerals policies.⁴⁰⁷

B. Materials Supply Interruptions Since World War II

Since World War II, the United States has had at least four major disruptions in the supply of materials critical to the economy and the national defense.⁴⁰⁸ The first of these occurred in 1949 when, in a Cold War exchange of trade restrictions with the United States over the Soviet blockade of Berlin, the Soviet Union stopped exporting manganese and chromium ore to the United States.⁴⁰⁹ The second interruption, from 1966 to 1972, was the United States boycott of chromium from Rhodesia, now Zimbabwe, as part of United Nations' sanctions against the former British colony's unilateral declaration of independence under a white minority government.⁴¹⁰ The third was a 1969 stoppage in the Canadian nickel import as workers carried on a prolonged strike.⁴¹¹ Most recently, a rebel invasion of Zaire's mining province, while not actually reducing cobalt production, triggered major disruptions in cobalt supplies, inventories, and prices.⁴¹²

1. Politically Motivated Embargoes: The Soviet Embargo of Manganese and Chromium, 1949, and the United States Embargo on Imports of Rhodesian Chromium, 1966-71

The Soviet Union's embargo on chromium and manganese exports to the United States was a Cold War political action between the

⁴⁰⁴ *Id.*

⁴⁰⁵ *Id.*

⁴⁰⁶ *Hearings on Geopolitics of Strategic and Critical Materials*, *supra* note 197, at 253.

⁴⁰⁷ *Id.*

⁴⁰⁸ TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 91-102.

⁴⁰⁹ *Id.* at 91-92.

⁴¹⁰ *Id.* at 92-94.

⁴¹¹ *Id.* at 94-97.

⁴¹² *Id.* at 97-102.

two super powers.⁴¹³ When the Soviet Union blockaded Berlin in 1948, the United States retaliated by prohibiting Soviet trade of industrial goods in the United States.⁴¹⁴ In response to the American action, the Soviet Union embargoed all raw materials shipments to the United States, including manganese and chromium.⁴¹⁵ The Rhodesian chromium embargo from 1966 to the end of 1971 was another politically motivated supply cutoff.⁴¹⁶ The boycott was imposed by the United States in conformance with a United Nations' resolution prohibiting member nations from buying Rhodesian chromium ore after Rhodesia declared independence from Great Britain and continued to govern by white minority rule.⁴¹⁷ The Soviet and Rhodesian embargoes did not affect seriously the United States economy or defense production.⁴¹⁸ The Soviet embargo, however, could have produced serious consequences because, at the time, the Soviets were supplying one-third of United States manganese and one-fourth of United States chromium.⁴¹⁹

The United States response in both of these cases was to find other foreign sources of supply.⁴²⁰ After the 1949 Soviet embargo, the United States actively sought alternative supplies by providing mine development loans, sending rail cars to South Africa and steel to India to upgrade their respective infrastructure and transportation systems.⁴²¹ The only action taken by the federal government to provide industry access to chromium supplies during the United States' boycott of Rhodesian chromium was to sell excess chromium from the national stockpile.⁴²² Industry was able to find alternate suppliers, and there was no significant supply shortage.⁴²³ Other factors, in addition to stockpile sales, eased the effects of the ban on Rhodesian imports. The Soviets increased chromium exports to the

⁴¹³ *Id.* at 15, 102.

⁴¹⁴ *Id.* at 91.

⁴¹⁵ *Id.*

⁴¹⁶ *Id.* at 15, 92-93. In 1971, Congress passed legislation removing the ban on United States import of Rhodesian chromium. *Id.* at 93. Members of Congress and the steel industry had protested the embargo complaining that it was forcing American steel producers to pay higher prices for chromium than their European and Japanese competitors had to pay, and that the sanctions against Rhodesia had caused the United States to become dangerously dependent on imports of chromium from the Soviet Union. *Id.*

⁴¹⁷ *Id.* at 15, 92.

⁴¹⁸ *Id.* at 15.

⁴¹⁹ *Id.* at 91.

⁴²⁰ *Id.* at 103.

⁴²¹ *Id.* at 91.

⁴²² *Id.* at 15.

⁴²³ *Id.*

United States despite the American involvement in the Indo-China War against their Vietnamese allies.⁴²⁴ Second, new suppliers entered the market and other countries increased chromium production as prices rose.⁴²⁵ Finally, the Rhodesian embargo was evaded by France, Japan, and Switzerland who resold Rhodesian chromium ore.⁴²⁶

2. The Canadian Nickel Strike, 1969

The 1969 Canadian nickel strike closed supplies from a "safe" foreign source at a time when Canada was almost the sole United States supplier.⁴²⁷ Unlike the politically inspired Soviet and Rhodesian embargoes, the Canadian nickel strike caused actual shortages and major price increases.⁴²⁸ The British, also highly dependent on Canadian nickel, suffered severe shortages.⁴²⁹ A British Institute of Geological Sciences spokesman referred to the 1969 nickel shortage as "perhaps the gravest metal crisis in the United Kingdom since the Second World War."⁴³⁰ The acute nickel shortage and high prices that followed the Canadian strikes produced efforts to conserve nickel consumption.⁴³¹ Users also turned to recycling from scrap and substitutions wherever possible. During the strike, prices encouraged more nickel production from other countries, and the United States released large quantities of the metal from the national stockpile.⁴³²

3. The Cobalt Panic of 1978-79

In 1977, rebels invaded Zaire's cobalt producing Shaba province in an attempt to create the independent state of Katanga.⁴³³ Although there was never any interruption of supply, the combination of rapidly rising world demand and fears of a supply cutoff triggered panic buying and high prices.⁴³⁴ The threat of African cobalt supply interruption has also surfaced as a result of the Angolan civil war

⁴²⁴ *Id.* at 15-16.

⁴²⁵ *Id.* at 93.

⁴²⁶ *Id.*

⁴²⁷ *Id.* at 102.

⁴²⁸ *Id.* at 94.

⁴²⁹ *Id.* at 96

⁴³⁰ *Id.*

⁴³¹ *Id.*

⁴³² *Id.*

⁴³³ *Id.* at 98.

⁴³⁴ *Id.* at 97.

that has closed that country's Benguela railway. The railway was a transportation route for shipping metals from Zaire and Zambia.⁴³⁵ During the cobalt shortage of 1978-79, cobalt users turned to substitutes and recycling wherever they could.⁴³⁶

C. The Effects of Supply Interruptions

In none of the four post-World War II supply interruptions did the United States suffer long-lasting damage.⁴³⁷ In each case, new producers entered the market, thus diversifying the supply, while some substitutions and recycling activities were instituted during the shortages that have become permanent procedures.⁴³⁸ Nevertheless, the issue of the United States' dependence on imports of critical materials is a major domestic issue. For some materials, alternate supplies are not as readily available today as they were in previous years. For example, small producers such as India and Turkey are not capable of expanding their manganese and chromium production to meet United States needs as they did in 1949.⁴³⁹ Furthermore, minerals technology has not changed significantly and minerals processing requires the same metals with little chance of substantial substitution.⁴⁴⁰

These four diverse historical examples of materials supply interruptions illustrate four important points. First, supply embargoes and interruptions of strategic materials are possible. Second, the Canadian nickel strike and the disruption in cobalt markets resulting from the invasion of Zaire's Shaba province showed that interruptions in metal supplies could have significant financial effects. Third, technology and consumer adjustment in the form of substitutions and recycling provided means to respond to supply interruptions in each example.⁴⁴¹ Finally, and most importantly, there is no one single answer to minerals import vulnerability.⁴⁴² A government policy for strategic materials must include a discussion of the full range of possible elements.⁴⁴³

⁴³⁵ *Id.*

⁴³⁶ *Id.* at 97-102.

⁴³⁷ *Id.* at 16.

⁴³⁸ *Id.* at 103.

⁴³⁹ *Id.* at 16-17.

⁴⁴⁰ *Id.*

⁴⁴¹ *Id.*

⁴⁴² *Id.*

⁴⁴³ *Id.* at 103.

VI. RECOMMENDATIONS TO REDUCE UNITED STATES IMPORT DEPENDENCY AND VULNERABILITY TO SUPPLY INTERRUPTIONS

Assured access to mineral resources at prices established in competitive markets is an important national concern. Resource availability and the extent to which the United States should rely on foreign mineral resources are very complex considerations. It is widely recognized that United States' achievement of complete minerals and materials self-sufficiency is highly unlikely.⁴⁴⁴ Nevertheless, the United States can take suitable steps to reduce import vulnerability to a sufficiently low level. Three of these approaches—substitution, conservation, and increased production—would reduce the nation's reliance upon materials imports. The remaining two approaches—stockpiling and improved foreign sources of supply—would not reduce import reliance but would diversify foreign minerals supplies and provide sufficient materials to meet emergency needs until a supply interruption could be overcome.⁴⁴⁵

A. Stockpiling

Congress created the Strategic and Critical Materials Stock Piling Act to provide a stockpile of vital minerals sufficient to sustain the nation for three years in the event of a national emergency.⁴⁴⁶ Stockpiling is an effective method to defend against possible supply cut-offs.⁴⁴⁷ The nation's present strategic stockpile, however, is inadequate.⁴⁴⁸ Current supplies are only at forty-eight percent of existing targets, with an overabundance of some minerals while others are nonexistent.⁴⁴⁹ At current funding levels, it will take over sixty years to fill the stockpile with the necessary amounts of minerals.⁴⁵⁰ The

⁴⁴⁴ *Id.* at 105.

⁴⁴⁵ CONGRESSIONAL HANDBOOK, *supra* note 18, at 229.

⁴⁴⁶ Strategic and Critical Materials Stock Piling Act, 50 U.S.C. § 98b (1982 & Supp. III 1985). At present, there are 93 strategic minerals in the stockpile valued at \$13 billion stored in 116 locations throughout the country. *Hearings on Geopolitics of Strategic and Critical Minerals*, *supra* note 197, at 259. These stockpiles include supplies for the first-tier critical minerals imported from South Africa—chromium, cobalt, manganese and platinum group metals. A REPORT ON U.S. MINERALS DEPENDENCE ON SOUTH AFRICA, *supra* note 350, at 15.

⁴⁴⁷ Plotkin, *supra* note 296, at 203.

⁴⁴⁸ See *Hearings on Geopolitics of Strategic and Critical Materials*, *supra* note 197, at 259; see also GENERAL ACCOUNTING OFFICE, REPORT TO THE CONGRESS, THE STRATEGIC AND CRITICAL MATERIALS STOCKPILE WILL BE DEFICIENT FOR MANY YEARS 5 (1978); McClure, *Stockpiling of Strategic and Critical Materials*, 19 IDAHO L. REV. 417 (1983).

⁴⁴⁹ *Hearings on Geopolitics and Critical Materials*, *supra* note 197, at 259.

⁴⁵⁰ *Id.* at 6 (statement of Sen. James A. McClure, Idaho).

federal government would have to invest about \$6 billion to raise the stockpile to the three-year defense goals.⁴⁵¹ It has been thirty years since significant purchases have been made for the national stockpile.⁴⁵² Additionally, Presidents Johnson, Nixon, and Reagan have sold minerals from the stockpile in efforts to balance the federal budget.⁴⁵³

It is in the national interest to maintain a fully supplied strategic stockpile.⁴⁵⁴ Therefore, a new policy should begin with adequate funds from Congress and executive support for an effective stockpile.⁴⁵⁵ Furthermore, the stockpile legislation should be revised.⁴⁵⁶ Current law provides that stocks can be released by Presidential order for national defense purposes during a time of war declared by Congress, or national emergency. The law also states that stocks cannot be released for general economic or budgetary purposes.⁴⁵⁷ The use of the stockpile in a period of national emergency such as a conventional war is the least likely cause of a supply interruption.⁴⁵⁸ The government stockpile system is also too cumbersome to cope with the diversity of industry's material requirements.⁴⁵⁹ The Stock Piling Act should therefore be amended to permit using stockpile inventories in situations other than war or to create a new stockpile intended specifically for such situations.⁴⁶⁰

The federal government should also enact legislation that requires major companies to maintain appropriate levels of critical minerals. A system of privately held stockpiles would offer several advantages by supplementing government inventories.⁴⁶¹ First, private stockpiles would be available for industry use in situations other than war.⁴⁶² The government stockpile could, therefore, concentrate on

⁴⁵¹ *Id.* at 259.

⁴⁵² *Id.*

⁴⁵³ *Id.*; England & Gertz, *supra* note 390, at 55.

⁴⁵⁴ *Hearings on Geopolitics of Strategic and Critical Materials*, *supra* note 197, at 259. Some observers, however, believe that a national stockpile is not that important to the nation's security. Meyer, *supra* note 8, at 68. They point out that the stockpile is predicated on providing minerals to fight a three-year conventional war and this seems unlikely in the nuclear age. *Id.* The Vietnam War, however, shows that the United States may become involved in a prolonged conventional conflict in the nuclear age.

⁴⁵⁵ *Hearings on Geopolitics of Strategic and Critical Materials*, *supra* note 197, at 259.

⁴⁵⁶ Shafer, *supra* note 81, at 163-66.

⁴⁵⁷ 50 U.S.C. §§ 98b(b), 98f(a) (1982 & Supp. III 1985).

⁴⁵⁸ Shafer, *supra* note 81, at 163.

⁴⁵⁹ *Id.* at 163-64.

⁴⁶⁰ *Id.* at 164.

⁴⁶¹ *Id.*

⁴⁶² *Id.* at 165.

stockpiling minerals for conventional military conflict.⁴⁶³ Private stockpiles, if decentralized, would not require additional government bureaucracies to manage them and would be readily available in the event of supply disruptions.⁴⁶⁴ As users, private industry would have the incentive to properly maintain inventories and thereby avoid the deterioration and obsolescence that is present in some strategic stockpiles.⁴⁶⁵

The federal government must take a number of steps to encourage a system of privately held stockpiles. These steps should include subsidies for storage and management of the mandatory stockpiles, tax relief to allow the companies to write off the capital costs of building the stockpiles more rapidly, low-cost loans for stockpile purchases, and favorable capital gains tax treatment of profits and losses on the mandatory inventories.⁴⁶⁶ "A decentralized system of privately held, government-subsidized stockpiles would provide valuable security against the most likely mineral security threat at a far lower cost than alternative strategies."⁴⁶⁷

B. Improved Foreign Sources of Supply

The United States is likely to be dependent on a few producing countries for most of its strategic materials supplies for the foreseeable future. Actions can be taken to increase the number of countries supplying these materials, thus achieving greater supply diversity.⁴⁶⁸ These actions, however, take time to implement. New mining operations can cost \$1 billion from exploration to production, with a time-consuming process to raise that capital.⁴⁶⁹ Moreover, mining ventures are long-term enterprises.⁴⁷⁰ It takes from two to five years to bring a new deposit into production.⁴⁷¹ Therefore, actions taken to promote diversity of supplies are not likely to be immediately successful in averting the consequences of a supply disruption.⁴⁷² Nevertheless, some policy options to diversify foreign supply sources

⁴⁶³ See *id.* at 163.

⁴⁶⁴ *Id.* at 165.

⁴⁶⁵ *Id.*

⁴⁶⁶ *Id.* at 165-66.

⁴⁶⁷ *Id.* at 166.

⁴⁶⁸ TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 356.

⁴⁶⁹ *Id.*

⁴⁷⁰ *Id.* at 357.

⁴⁷¹ *Id.*

⁴⁷² *Id.*

of specific minerals could help reduce overall United States vulnerability to a supply disruption.⁴⁷³

Increased reliance on relatively secure sources of supply, such as Canada, Mexico, and Australia, would reduce risks in minerals import dependence.⁴⁷⁴ Of the first-tier minerals, prospects for supply diversification appear to be best for manganese, which already has the most diverse supply.⁴⁷⁵ Several alternative supply sources also exist for chromium, such as expanding production in Turkey and the Philippines.⁴⁷⁶ Cobalt diversification, primarily in the Southwest Pacific, depends to a large extent upon world nickel and copper markets because cobalt is usually a by-product of nickel and copper production.⁴⁷⁷ In the case of platinum group metals, the most promising known but non-producing deposit is in the United States. Outside the United States prospects for platinum group metal supply diversification will depend on new discoveries rather than on the development of known deposits.⁴⁷⁸

Supply diversity requires investment in and construction of new or expanded mining and transportation facilities. Furthermore, private industry has little motivation to spend its own resources to seek new supplies of critical minerals when known reserves in southern Africa and deposits in other countries can be mined more easily.⁴⁷⁹ The United States, therefore, must adopt policies to encourage supply diversity.⁴⁸⁰ The federal government must devise programs involving a large government subsidy to bring about such diversity on an economic basis. Low interest loans and tax write-offs should also be available to encourage investment in foreign mining operations.⁴⁸¹ In at least one industrialized country, the government supports mineral development projects launched by private firms overseas.⁴⁸² In Japan, a country deprived of domestic natural resources, overseas ventures of sufficient importance to be considered "national projects" are backed by low-interest loans to both the country in which the project is located and the consortium of Japanese firms involved in

⁴⁷³ CONGRESSIONAL HANDBOOK, *supra* note 18, at 301.

⁴⁷⁴ *Id.* at 321-628; see also *Hearings on Geopolitics of Strategic and Critical Materials*, *supra* note 197, at 265.

⁴⁷⁵ TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 26, 32.

⁴⁷⁶ *Id.* at 20, 32.

⁴⁷⁷ *Id.* at 23.

⁴⁷⁸ *Id.* at 27-28.

⁴⁷⁹ A REPORT ON U.S. MINERALS DEPENDENCE ON SOUTH AFRICA, *supra* note 350, at 17.

⁴⁸⁰ *Id.*

⁴⁸¹ CONGRESSIONAL HANDBOOK, *supra* note 18, at 328-31, 333-34.

⁴⁸² *Id.* at 330.

the project. The government itself serves as the major stockholder in the consortium.⁴⁸³

In the United States, private industry, and not government, is the primary entity responsible for securing mineral supplies from foreign sources. The federal government, however, could encourage private investment in foreign mining operations "through the dissemination of essential information, by facilitating interaction between private industry and foreign owners, and by the targeting of international aid to private and producer-country mining activities that are related to strategic minerals."⁴⁸⁴ Programs that encourage United States investment in mining in economically attractive sites overseas should also be continued and perhaps enhanced. Legislation extending the Overseas Private Investment Corporation,⁴⁸⁵ the United States government's program to insure American investments overseas, should be supported. The Reagan administration's interest in internationally sponsored insurance programs for overseas investment should be implemented.⁴⁸⁶

The most important steps the United States can take to increase its security of mineral supplies from foreign sources is in the foreign policy area.⁴⁸⁷ The United States must establish foreign policies that recognize defense and national security interests in relation to the continued supply of strategic materials and seek to maintain relationships with strategic, mineral-rich nations.⁴⁸⁸ The United States must implement preventive foreign policy actions. United States diplomacy should be used to try to prevent international conflicts in mineral-producing regions.⁴⁸⁹ First, the United States must work toward peaceful change in South Africa, including Namibian independence.⁴⁹⁰ Second, the United States should challenge the Cuban and Soviet presence in Angola as part of an overall strategy for Cuban-Soviet withdrawal.⁴⁹¹ The United States should also expand its economic development assistance programs to countries with

⁴⁸³ *Id.* at 331-32.

⁴⁸⁴ TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 357.

⁴⁸⁵ 22 U.S.C. § 2191 (1969).

⁴⁸⁶ TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 357-61.

⁴⁸⁷ Shafer, *supra* note 81, at 168.

⁴⁸⁸ *Hearings on Geopolitics of Strategic and Critical Materials*, *supra* note 197, at 265; see also CONGRESSIONAL HANDBOOK, *supra* note 18, at 335-39.

⁴⁸⁹ Shafer, *supra* note 81, at 168; A REPORT ON U.S. MINERALS DEPENDENCE ON SOUTH AFRICA, *supra* note 350, at 18-19.

⁴⁹⁰ Shafer, *supra* note 81, at 171; A REPORT ON U.S. MINERALS DEPENDENCE ON SOUTH AFRICA, *supra* note 350, at 18-19.

⁴⁹¹ Shafer, *supra* note 81, at 171.

strategic minerals that are important to the American economy and national defense.⁴⁹² The United States should also strengthen its military capabilities in the event such intervention is needed as a "last resort" to prevent a serious interruption of critical minerals.⁴⁹³

C. Substitution

Substitution of materials that are relatively plentiful and noncritical for those that are imported is one of the most attractive approaches for a long-term solution to reducing United States mineral import dependency.⁴⁹⁴ In this vein, "[s]ome experts have predicted that the world may be entering an 'Age of Substitutability' in which the technical problems of substitution will have been sufficiently solved to permit virtually unlimited interchangeability of materials."⁴⁹⁵ There are two broad classes of substitute materials: advanced materials and direct substitutes.⁴⁹⁶ Advanced materials, sometimes referred to as economic substitutes, eventually may displace currently used materials because the new material offers performance, cost, or other advantages.⁴⁹⁷ In contrast, direct substitutes, sometimes referred to as emergency substitutes, are materials that are not preferred but could replace materials used currently during an emergency.⁴⁹⁸

To be effective, substitute materials must meet four criteria. First, the material must be available domestically or available from reliable sources.⁴⁹⁹ Second, the substitute material must be equal in performance to the old material.⁵⁰⁰ Third, the new material must have demonstrated properties.⁵⁰¹ Finally, processing and fabrication of the substitute material must be accomplished with little design changes for use.⁵⁰² Currently there is a great deal of interest in the development of advanced materials such as ceramics, composites (combinations of two or more materials), and unconventional metallic materials that have properties suggesting that they might serve as

⁴⁹² *Id.* at 168-69.

⁴⁹³ CONGRESSIONAL HANDBOOK, *supra* note 18, at 339-40.

⁴⁹⁴ *Id.* at 250.

⁴⁹⁵ *Id.*

⁴⁹⁶ TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 362.

⁴⁹⁷ *Id.*

⁴⁹⁸ CONGRESSIONAL HANDBOOK, *supra* note 18, at 252; TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 362.

⁴⁹⁹ CONGRESSIONAL HANDBOOK, *supra* note 18, at 256.

⁵⁰⁰ *Id.*

⁵⁰¹ *Id.*

⁵⁰² CONGRESSIONAL HANDBOOK, *supra* note 18, at 256; *see also* TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 265-66.

substitutes for conventional materials requiring strategic metals.⁵⁰³ This interest is the result of the diversity of properties these new materials offer.⁵⁰⁴ They not only offer enhanced properties but often present entirely new combinations of properties that may provide the basis for important new United States industries.⁵⁰⁵ Furthermore, advanced materials use little or reduced amounts of first-tier minerals, and over the long term, they will displace or reduce some strategic material requirements.⁵⁰⁶

Substitution offers considerable potential to reduce United States materials import vulnerability with respect to chromium, cobalt and platinum group metals. Because of the satisfactory performance, however, reasonable cost, and familiarity of chromium, cobalt, and platinum group metals, there has been little interest in developing, testing, certifying, or using substitutes.⁵⁰⁷ There is little chance, however, that a substitute for chromium in stainless steel production, which accounts for one-half of the total United States chromium demand, will be found.⁵⁰⁸ Furthermore, the outlook for substitution of platinum group metals in catalytic applications is dim.⁵⁰⁹ Most manganese consumption is in steelmaking, and in this application there is currently no satisfactory alternative.⁵¹⁰

The development of substitute materials is very costly⁵¹¹ and the federal government must play a primary role in sponsoring research on advanced materials.⁵¹² Government support of research and development with regard to advanced materials should be increased. Japan, Great Britain, and some Western European countries are placing more emphasis than the United States in research and de-

⁵⁰³ TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 285.

⁵⁰⁴ *Id.*

⁵⁰⁵ *Id.*

⁵⁰⁶ *Id.* at 285, 368. Advanced ceramic materials and composites, defined as the combination of two or more materials, yield a product with high strength and stiffness, low weight, and good corrosion and chemical resistance. *Id.* at 286, 301. Despite the potential for substitution, advanced ceramic materials and composites will not substantially displace first-tier strategic materials within the next decade. *Id.* at 286, 302. Ceramic materials are too brittle to withstand the stresses of most system designs. *Id.* at 286. The high cost of advanced composite materials deters their widespread use. *Id.* at 303. Nevertheless, advanced ceramics may become an international business with markets reaching over \$20 billion by the year 2000. *Id.* at 368. And advanced composites will be used increasingly in the transportation and aerospace industries. *Id.* at 310-12.

⁵⁰⁷ *Id.* at 21-22, 25, 28, 268-84; CONGRESSIONAL HANDBOOK, *supra* note 18, at 258-61.

⁵⁰⁸ TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 21-23.

⁵⁰⁹ *Id.* at 28.

⁵¹⁰ *Id.* at 27; CONGRESSIONAL HANDBOOK, *supra* note 18, at 260.

⁵¹¹ TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 263.

⁵¹² *Id.* at 362-33, 369-70.

velopment activities of alternative materials.⁵¹³ Materials research activities, however, "are fragmented, without focus, and suffer from lack of coordination."⁵¹⁴ The federal government must improve the management and coordination of federal materials research efforts if the national materials policies goals are to be achieved.⁵¹⁵ In addition to supporting the development of advanced materials through research programs, the federal government can reduce United States dependency on foreign imports by making information about substitutes widely available to consumers and by developing, testing, and certifying new materials.⁵¹⁶

D. Conservation

Past experience has demonstrated that conservation may be an important response to critical materials and minerals shortages. In all of the post-World War II supply disturbances discussed in this Article, industry responded with increased conservation efforts.⁵¹⁷ Variations of conservation offer ways to reduce United States dependence on foreign strategic materials sources. Recycling, product life extension, trimming of alloy additions to the low side of acceptable ranges, and improved processing techniques are all potentially effective in reducing dependence.⁵¹⁸

In the case of manganese, it is likely that steelmaking technology improvements will continue so that United States imported manganese requirements will decline sharply.⁵¹⁹ Important opportunities also exist to increase cobalt, chromium, and platinum group metals supplies through recycling. In the case of platinum group metals, the chief opportunity for conservation is through recycling of automotive catalysts.⁵²⁰ Recovery of chromium and cobalt from steelmaking, industrial, and chemical waste and improved recycling techniques are additional ways to reduce United States dependence on foreign sources of first-tier minerals.⁵²¹ Increasing conservation efforts not only adds to strategic material supplies but also benefits

⁵¹³ See *id.* at 368-69.

⁵¹⁴ NEED FOR NATIONAL MATERIALS POLICY & PLANNING, *supra* note 4, at 44.

⁵¹⁵ *Id.*

⁵¹⁶ *Id.* at 34.

⁵¹⁷ TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 215.

⁵¹⁸ *Id.*; see also CONGRESSIONAL HANDBOOK, *supra* note 18, at 268-78.

⁵¹⁹ TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 227-38.

⁵²⁰ See *id.* at 36, 238-45.

⁵²¹ *Id.* at 36, 245-54; see also CONGRESSIONAL HANDBOOK, *supra* note 18, at 279-83; GENERAL ACCOUNTING OFFICE, REPORT TO THE CONGRESS, INDUSTRIAL WASTES: AN UNEXPLORED SOURCE OF VALUABLE MINERALS (1980).

the environment by reducing landfilling and disposal of waste. Recycling is also an energy conservation measure because scrap has already been processed from raw ores to metal form.⁵²²

The federal government should undertake three steps to improve the prospects for strategic materials conservation. First, the federal government should provide update information on the recycling of strategic materials. Data on scrap containing strategic materials is incomplete. With more accurate information, the federal government could develop more effective programs to enhance scrap recovery. Congress could direct the Bureau of Mines to conduct and regularly update surveys of the disposal of scrap containing strategic minerals. Information from these surveys could be used to direct research in alternative materials and conservation, update the national defense stockpile, and identify investment opportunities for industry.⁵²³ Second, the federal government must identify specific actions to support strategic materials recycling, such as structuring taxation, procurement, environmental, and other policies to encourage increased recycling.⁵²⁴ Surplus federal property recycling, especially Department of Defense property surplus, provides an opportunity to conserve strategic materials. The Department of Defense has conducted a precious metals recovery program from surplus government property.⁵²⁵ This program provides a precedent for a government-operated recycling program and should be expanded government-wide.⁵²⁶ Finally, the federal government must increase funding of research and development activities aimed at improving recycling technologies.⁵²⁷ Private industry is not likely to invest in recycling technology research and development so long as low-priced metal from foreign sources is readily available.⁵²⁸

E. Increased Domestic Raw Materials Supply

1. Increased Onshore Exploration and Development

The highly industrialized United States economy is critically dependent upon an adequate and stable supply of many materials and minerals. While the United States currently possesses an abundance

⁵²² TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 372.

⁵²³ *Id.* at 36, 372-74.

⁵²⁴ *Id.* at 36-37, 374-76.

⁵²⁵ *Id.* at 376.

⁵²⁶ *Id.* at 376.

⁵²⁷ *Id.* at 376-78.

⁵²⁸ *Id.* at 36.

of renewable and nonrenewable material resources, it has a confusing and contradictory minerals policy that has impeded the development of domestic mineral deposits.⁵²⁹ The first step to increase domestic raw material supply, therefore, is the development of an effective and coherent national minerals policy to encourage domestic mineral production.⁵³⁰

Such policy reform should achieve three results concerning the increased use of federal lands. First, the federal government should centralize all activities relating to mineral development within one executive body and require that land use plans and policies be developed only after a full assessment of an area's mineral resources. Second, the federal government should implement a mechanism for reevaluating lands withdrawn or restricted from mineral development to determine whether these lands should be opened to mineral development to meet national security requirements. Finally, public lands should be more accessible for mineral exploration and development.⁵³¹

Of twenty-nine strategic and critical minerals, Alaska has development potential for eighteen, including the four first-tier minerals.⁵³² Outside of Alaska, the potential for discovery of commercially exploitable deposits of the first-tier strategic mineral deposits in the United States is insufficient to generate widespread prospecting efforts.⁵³³ The fact that there is little possibility of discovering domestic deposits of chromium, cobalt, manganese, or platinum group metals does not rule out the possibility that there may be significant undiscovered deposits.⁵³⁴ Little domestic exploration for the first-tier minerals, however, is occurring. The high cost of exploration

⁵²⁹ Note, *supra* note 94, at 904.

⁵³⁰ U.S. MINERALS VULNERABILITY REPORT, *supra* note 19, at 80-81.

⁵³¹ *Id.* at 81; see also Note, *supra* note 94, at 904.

⁵³² *Hearings on Geopolitics of Strategic and Critical Materials*, *supra* note 197, at 31 (statement of Sen. Frank H. Murkowski, Alaska). A 1978 study on the potential impact of the withdrawal of Alaskan federal lands pursuant to the Alaska National Interest Lands legislation concluded that a mining industry could develop in Alaska by the 1990s that would:

[1] Provide . . . substantial quantities of nonfuel minerals, including gold, silver, copper, nickel, lead, zinc, molybdenum and asbestos, valued at between \$900 million and \$1 billion annually (in 1977 dollars).

[2] Provide . . . 20,000 to 40,000 additional jobs, representing about 0.5 percent of current unemployment.

[3] Reduce the . . . balance of payments deficit by between \$700 million and \$1 billion annually (in 1977 dollars).

AN ANALYSIS OF THE U.S. MINING INDUSTRY, *supra* note 82, at 20. For discussion on the potential of domestic onshore mineral exploration, see Ridgeway, *Stalking Strategic Metals*, SCI. DIGEST, Feb. 1983, at 42.

⁵³³ TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 351.

⁵³⁴ *Id.*

and the unlikelihood of locating deposits of these minerals impedes domestic exploration.⁵³⁵

The federal government must take several steps to increase the potential for discovery of domestic resources of the first-tier and other minerals. The government must provide economic incentives, principally through the tax system, to improve domestic mineral exploration economics.⁵³⁶ United States tax laws that recognize the importance of the mining industry—percentage depletion allowances and expensing of exploration and development—must be continued.⁵³⁷ Tax law reform should consider several critical changes. First, the investment tax credit, an important incentive to capital formation, should be extended to include all buildings used in mining and minerals processing.⁵³⁸ The credit should be increased to stimulate replacement of older equipment. Second, depreciation schedules should be liberalized to permit faster and more realistic capital recovery.⁵³⁹ Finally, the costs of environmental and health and safety regulations should be deducted by the taxpayer.⁵⁴⁰ These acts would also promote capital formation needed to finance domestic mining operations.⁵⁴¹

Tax incentives, however, can only improve the cost of development projects by a limited amount, and additional government action is required if strategic mineral domestic exploration is to be encouraged.⁵⁴² The federal government should revise antitrust laws and policy to promote joint ventures, pooling of money, skills, and equipment by two or more companies and end the adversarial relationship between the government and the minerals industries.⁵⁴³ Congress should apply cost-benefit analyses to all environmental legislation to ensure that the goals sought will be attainable economically without imposing a disproportionate burden on the minerals industry.⁵⁴⁴ In promulgating regulations, the administrative bodies should also balance the environmental objectives against the implementation cost.⁵⁴⁵

⁵³⁵ *Id.* at 32; see also *id.* at 351–53.

⁵³⁶ *Id.*; see also Plotkin, *supra* note 296, at 203–04.

⁵³⁷ U.S. MINERALS VULNERABILITY REPORT, *supra* note 19, at 42.

⁵³⁸ *Id.*

⁵³⁹ *Id.*

⁵⁴⁰ *Id.* at 42; see *Hearings on Geopolitics of Strategic and Critical Materials*, *supra* note 197, at 264.

⁵⁴¹ See U.S. MINERALS VULNERABILITY REPORT, *supra* note 19, at 82.

⁵⁴² TECHNOLOGIES TO REDUCE U.S. IMPORT VULNERABILITY, *supra* note 4, at 32.

⁵⁴³ See U.S. MINERALS VULNERABILITY REPORT, *supra* note 19, at 82.

⁵⁴⁴ *Hearings on Geopolitics of Strategic and Critical Materials*, *supra* note 197, at 264.

⁵⁴⁵ *Id.*; U.S. MINERALS VULNERABILITY REPORT, *supra* note 19, at 82–83.

2. Deep Seabed Mining

Deep seabed mining offers the greatest promise to reduce United States mineral supplies dependency on potentially unstable foreign sources.⁵⁴⁶ Much of the deep seabed is covered with nodules that contain hard minerals including nickel, copper, cobalt, and manganese.⁵⁴⁷ The United States will benefit if these hard mineral resources are developed and made available for domestic use.⁵⁴⁸ Commercial recovery of deep seabed mineral resources could reduce the nation's dependence on foreign sources of nonfuel minerals⁵⁴⁹ because deep seabed nodules contain four minerals in commercial proportions,⁵⁵⁰ all vital to United States industrial production.⁵⁵¹ With the exception of copper, the United States is heavily dependent on foreign sources for its supply of these metals.⁵⁵²

Manganese nodules were first discovered in 1873 on the deep Pacific ocean seabed during the scientific research expedition of the wooden steamship H.M.S. Challenger.⁵⁵³ The nodules were recognized then to be rich in several minerals, but they remained a scientific curiosity until advanced technology and contemporary price increases made the commercial development of these resources possible and profitable.⁵⁵⁴

⁵⁴⁶ See CONGRESSIONAL HANDBOOK, *supra* note 18, at 73.

⁵⁴⁷ *Id.*; 30 U.S.C. § 1401(a)(4) (1982).

⁵⁴⁸ 30 U.S.C. § 1401(a)(5).

⁵⁴⁹ *Id.* § 1401(a)(2)-(6).

⁵⁵⁰ Prime nodules consist of 27% to 30% manganese, 1.1% to 1.4% nickel, 1.0% to 1.3% copper, and 0.2% to 0.4% cobalt. R. ECKERT, *THE ENCLOSURE OF OCEAN RESOURCES* 219 (1979); *see also* J. MERO, *THE MINERAL RESOURCES OF THE SEA* 225-30 (1965).

⁵⁵¹ H.R. REP. NO. 411, 96th Cong., 2d Sess. 36, *reprinted in* 1980 U.S. CODE CONG. & ADMIN. NEWS 1600, 1601.

⁵⁵² *See* 30 U.S.C. § 1401(a)(1)-(4) (1982).

⁵⁵³ J. SULLIVAN, *PACIFIC BASIN ENTERPRISE AND THE CHANGING LAW OF THE SEA* 4 (1977).

⁵⁵⁴ *Id.* Nodules are rounded masses of manganese oxide that have developed through the gradual accretion of minerals chemically precipitated around some minute nucleus like a grain of sand. D. LEIPZIGER & J. MUDGE, *SEABED MINERALS RESOURCES AND THE ECONOMIC INTERESTS OF DEVELOPING COUNTRIES* 124 (1976). They are generally earthy black in color and vary in size from 0.5 to 25 centimeters, averaging about 3 centimeters. *Id.*; J. MERO, *supra* note 550, at 129-32. The nodules either form in clusters like oversized grapes or are strewn one layer thick in fields resembling a mosaic of potato-shaped forms, partly embedded in a smooth layer of mud. R. ECKERT, *supra* note 550, at 215; *see* J. MERO, *supra* note 550, at 133, 142, 146, 156-63.

The average growth rate for nodules is estimated to be about 0.1 millimeter every one thousand years. The growth has been characterized as "one of the slowest chemical reactions in nature, [measured in] atomic layers per day." R. ECKERT, *supra* note 550, at 215 (quoting B. HEEZEN & C. HOLLISTER, *THE FACE OF THE DEEP* 423 (1971)). At this accretion rate, it

The exploration and development of deep seabed mineral deposits may contribute to a long-term solution to the security of supply of critical minerals found in manganese nodules. It has been estimated that the total quantity of manganese nodules lying on the Pacific seabed alone is 1.7 trillion metric tons.⁵⁵⁵ A single ocean mining site recovering three million tons of nodules per year could produce 42,000 tons of nickel, 37,000 tons of copper, 4,000 tons of cobalt, and 750,000 tons of manganese.⁵⁵⁶ Such a mining site could supply approximately five percent of the world's nickel production, one-half to one percent of copper, twelve percent of cobalt, and seven percent of manganese production.⁵⁵⁷

On April 30, 1982, the United Nations adopted by a vote of 130 to four, with seventeen abstentions, a new law of the sea treaty.⁵⁵⁸ The United States, however, voted against the proposed treaty because of the seabed mining provisions.⁵⁵⁹ In a presidential statement issued on July 9, 1982, President Reagan announced that the United States would not sign the treaty adopted by the conference. The President concluded that the proposed deep seabed mining regime did not protect United States economic and security interests and thus would not receive the United States' support.⁵⁶⁰ The federal government, however, has authorized domestic firms to mine the deep seabed. By enacting the Deep Seabed Hard Minerals Resources Act of 1980,⁵⁶¹ Congress identified direct access to seabed resources as a desirable alternative source of supply to imported materials and authorized United States companies to mine in waters beyond national jurisdiction.⁵⁶²

VII. CONCLUSION

Assured access to mineral resources at prices established in competitive markets is an important concern to the nation. Fortunately, compared with most nations, the United States is rich in mineral resources. In recent years, however, several actions of the federal

would take 200,000 years to replace the existing supply of nodules on the floor of the Pacific Ocean. J. MERO, *supra* note 550, at 154, 175-78.

⁵⁵⁵ *Id.* at 175.

⁵⁵⁶ *Id.*

⁵⁵⁷ *Id.*

⁵⁵⁸ N.Y. Times, May 1, 1982, at 9, col. 1.

⁵⁵⁹ *Id.*

⁵⁶⁰ *Id.*; BUS. WK., May 24, 1982, at 196.

⁵⁶¹ 30 U.S.C. §§ 1401-1473 (1982 & Supp. III 1985).

⁵⁶² *Id.* § 1401.

government have reduced the profitability of domestic mineral projects, making investments in such projects less attractive than they otherwise would have been. In general, United States government actions have tended to do more to discourage and less to stimulate investment in domestic mineral projects through restricting the use of federal lands for mineral exploration, imposing strict environmental requirements, restricting the use of joint ventures to pool resources, and adding to labor costs by establishing worker health and safety requirements.

The decline of the United States mining and mineral-processing industry has resulted in lost jobs and job opportunities in the industry, has adversely affected the United States balance of trade, and has increased concerns about the United States' vulnerability to mineral supply disruptions. In addition, the absence of a coherent government minerals policy has created much uncertainty about the future mineral supply availability.

The United States relies heavily on a few countries for its supplies of strategic materials, the bulk of which comes from countries or regions that are either politically unstable or ideologically hostile to the United States. As a result, the United States may face disruptions in the supply of these materials that could be damaging to the national defense and the economy of the nation. The United States must develop comprehensive policies to protect itself in the event that the supply of critical and strategic minerals are severed.

APPENDIX

Table 1.
Global Resource Availability

Resource	Years Available at Present Growth Rate*
Aluminum	31
Chromium	95
Coal	111
Cobalt	60
Copper	21
Gold	9
Iron	93
Lead	21
Manganese	46
Mercury	13
Molybdenum	34
Natural Gas	22
Nickel	53
Petroleum	20
Platinum Group**	47
Silver	13
Tin	15
Tungsten	28
Zinc	18

* The number of years that known global reserves will last with consumption growing exponentially at the average annual rate of growth.

** The platinum group metals are platinum, palladium, iridium, osmium, rhodium, and ruthenium.

Source: D. Meadows, D. Meadows, J. Randers and W. Behrens, *The Limits to Growth: A Report for the Club of Rome's Project on the Predicament of Mankind* 56-60 (1972).

Table 2.
Increase in Known World Reserves of Selected Natural Resources*

Resource	1950	1970	Percent Increase Since 1950
Tin	6000	6600	+10%
Manganese	500,000	635,000	+27%
Zinc	70,000	113,000	+61%
Lead	40,000	86,000	+115%
Copper	100,000	279,000	+179%
Bauxite	1,400,000	5,300,000	+279%
Oil	75,000,000	455,000,000	+507%
Chromite	100,000	775,000	+675%
Iron	19,000,000	251,000,000	+1221%
Potash	5,000,000	118,000,000	+2360%
Phosphates	26,000,000	1,178,000,000	+4430%

* Amounts, in thousands of metric tons, estimated to exist in known lodes reservoirs.

Source: Simon, *The Scarcity of Raw Materials: A Challenge to the Conventional Wisdom*, Atlantic, June 1981, at 33, 34.

Table 3.
United States Net Import Reliance on Selected Strategic Minerals as a Percent of
Apparent Consumption, 1984

Mineral	Percent	Major Foreign Source	Mineral Usage
Bauxite and Alumina**	96	Jamaica, Guinea, Suriname	Aluminum production, abrasive, building materials
Chromium*	82	South Africa, Zimbabwe, Soviet Union	Alloys for springs, bearings, tools, engines
Cobalt*	95	Zaire, Zambia, Canada	Alloys for tool bits, high-strength steel, aircraft engines
Columbium**	100	Brazil, Canada, Thailand	High-strength alloys for construction, jet engines, machine tools
Diamonds**	100	South Africa, Zaire, Britain	Machinery, mineral services, stone and ceramic products, abrasives
Graphite**	90	Mexico, China, Brazil	Foundry operations, lubricants, brake linings
Manganese*	99	South Africa, Gabon, France	Steel production, batteries, chemicals
Platinum*	91	South Africa, Britain, Soviet Union	Oil refining, telecommunications, chemical processing, medical and dental equipment
Rutile**	61	Australia, Sierra Leone, South Africa	Paint, plastics, paper, welding-rod coatings
Tantalum**	94	Thailand, Malaysia, Brazil	Nuclear reactors, aircraft parts, surgical instruments
Tin**	79	Thailand, Malaysia, Indonesia	Cans and containers, electrical products, construction, transportation
Vanadium**	41	South Africa, Canada, Finland	Iron alloys, steel alloys, titanium alloys, sulfuric-acid production

* Considered essential to United States defense.

** Considered essential to United States economy.

Source: *Foreign Metals—An Achilles' Heel for U.S.*, U.S. News & World Report, Mar. 18, 1985, at 74.

Table 4.
United States Strategic Metal Consumption by Industrial Sector, 1980

Sector	Chromium		Cobalt		Manganese		Platinum group	
	1,000 tons	(Percent)	1,000 lb	(Percent)	1,000 tons	(Percent)	1,000 tr oz	(Percent)
Transportation	112	(19)	7015	(41)	215	(21)	731	(33)
Construction	123	(21)	0	(0)	375	(36)	171	(8)
Machinery	98	(17)	3081	(18)	165	(16)	0	(0)
Electrical	52	(9)	2530	(15)	67	(7)	526	(24)
Refractory	44	(7)	538	(3)	0	(0)	63	(3)
Chemical	87	(15)	3785	(22)	50	(5)	284	(13)
Other	71	(12)	190	(1)	157	(15)	431	(20)
Total	587	(100)	17,139	(100)	1,029	(100)	2,206	(100)

Source: Office of Technology Assessment, United States Congress, *Strategic Materials: Technologies to Reduce U.S. Import Vulnerability* 62 (OTA-ITE-248) (May 1985).

Table 5.
Federal Land Ownership in the Western States

State	Percentage of land owned by U.S. in 1975
Alaska	88
Arizona	44
California	46
Colorado	36
Idaho	65
Montana	30
Nevada	86
New Mexico	33
Oregon	52
Utah	63
Washington	29
Wyoming	49

Source: Bureau of Land Management, United States Department of the Interior, *Public Lands Statistics 1984* 10 (1985).